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GEORGICAL

ESSAYS:

BY

A. HUNTER, M. D. F. R. S. L. & E.

NISI UTILE EST QUOD FACIMUS STULTA EST GLORIA. *Phæd.*

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GEORGICAL ESSAYS.

ESSAY I.

On the beneficial Effects of a Spirited Agriculture.

AGRICULTURE, in every civilized nation, has been justly regarded as an object of the first importance, and, of all the useful arts, the most deserving of public attention and encouragement. At the same time that it furnishes a steady supply of all the neceſsary means of subsistence, and comfortable accommodation to the individual, it contributes, most eſsentially, to the strength, the opulence, and the independence of the State. It must, therefore, appear surprising, that in this country, so much distinguished by other improvements, the improvement of the soil should have continued so long the object of general neglect, and should never, till of late, have received that public encouragement, to which it has so just a claim.

Literary merit has been patronised by the most distinguished names. Improvements in the arts and sciences have been encouraged by public honours and rewards. Laws and regulations have been established, and bounties held out, to give energy and ſucceſs to the exertions of the merchant and manufacturer. Much blood and treasure have been spent in the acquisition of foreign territory, and foreign trade; and the lives of many thousands have been hazarded and lost, for their extension and defence. But the cultivation and improvement of our native soil, though an object undeniably of the first consequence to the nation, has been, in a great measure, overlooked, and suffered to languish under the preſsure of numberleſs hardships and discouragements.

Public neglect, however, is not the only misfortune which agriculture hath experienced. From the indolence and inattention of the proprietors themselves, it hath suffered still more severely. Blind to their own private interest, as well as to the general good of their country, they continued long to regard husbandry with an indifferent eye, and have never, generally, till within these few years, taken any proper measures to extricate their estates from that wretched system of management to which, from time immemorial, they had been unhappily subjected.

In many instances, and at a period not very remote, the pride of family distinction, attaching the idea of meanneſs to the labours of the peasant, led gentlemen of fortune to consider practical farming as beneath their rank, and as bringing them too much upon a level with the inferior orders of society. Besides, the greater part of our young noblemen and gentlemen were trained up in the persuasion, that the science of agriculture formed no part of the education, and the knowledge of rural economy, none of the accomplishments, that belong to men of rank and fashion. The consequence of this has been an almost total ignorance, and a rooted dislike, of the operations of husbandry among that order of men, who are most concerned and best able to promote its improvement. Abstracting themselves entirely from country affairs, they engaged in other employments deemed more honourable, or more suitable to their station, or else devoted their time to the pleasures and amusements of gay life, at a distance from their estates, which they seldom visited, and of which they knew little, except, perhaps, the amount of the rental. The cultivation of their lands was, of course, left to the management of a claſs of men, generally without knowledge, without capital, and without enterprise; attached to the customs and fashions of their fathers, and as unwilling to adopt, as they were unable to form, any rational plan of improvement.

It must be admitted, however, that this charge of neglect does not apply universally. Upwards of forty or fifty years ago, many gentlemen both in England and Scotland, began to study agriculture as a science, and to regard practical husbandry as an honourable as well as a profitable employment. By a course of experiments and observations, and at no inconsiderable expense, they gradually introduced an improved system of husbandry into their estates; by which means, they have at last brought them to a high state of cultivation. In every county or district where this has taken place, the consequences are visible and striking. The value of land has increased amazingly. The tenants are in a thriving condition, and many of them rising to affluence. It must be acknowledged, likewiſe, to the credit of the farmers, that many of them have diſplayed much ſkill and induſtry in the cultivation of their farms; and have contributed, in no ſmall degree, to the improvement of practical huſbandry.

The effects, however, of theſe laudable exertions have been partial and limited. They have awakened the public attention; they have thrown much light upon this important ſubject; and have done much good in particular counties and diſtricts. But they have never been able to diffuſe a ſpirit of induſtry and improvement generally through the kingdom; nor to eſtabliſh a ſyſtem of agriculture upon principles capable of univerſal application.

When theſe circumſtances are conſidered, we cannot wonder that the progreſs of agriculture has been ſo ſlow, and that, in ſo few inſtances, it hath reached to any degree of perfection. If I am rightly informed, a comparatively ſmall part of the kingdom can boaſt of a complete ſtate of cultivation. A very large proportion, though in a progreſsive ſtate of improvement, is ſtill, by many degrees, ſhort of perfection. And vaſt tracts of land, capable of cultivation, still remain in a state of nature, or under a course of management, little superior to what existed some centuries ago.

The period, however, is now arrived, when the eyes of the nation seem to be opened; and a taste and spirit for agricultural improvement, which, for some time, have been advancing with slow laborious steps, are now beginning to operate with a vigour and to an extent hitherto unknown. By the persevering efforts of a patriotic individual, a BOARD of AGRICULTURE has been established, for the purposes of collecting information respecting the present state of husbandry through the nation; of rousing and spreading a spirit of industry among the people; and of devising and employing the most effectual means of accelerating and bringing to perfection the cultivation of the soil in every part of Great Britain.

From such an institution, patronized by our Gracious Sovereign, sanctioned by the authority of Parliament, and under the management of the first names in the kingdom, we are warranted to prognosticate the happiest effects, An increase of produce, both of grain and of live-stock, which will advance in proportion to the degree of perfection to which improvements in Agriculture are carried, must be the immediate and happy consequence. This will not only secure us from scarcity and famine, evils ever dreadful to a nation, but will afford an abundant supply of food for the inhabitants; and not infrequently a large surplus for exportation; besides furnishing in greater quantity, and of an improved quality, the raw materials of many of our most valuable and profitable manufactures, such as wool, flax, hides, tallow, &c. As Agriculture advances, the number of inhabitants will, of course, multiply: for population always keeps pace with the cultivation of the soil. Productive labour, the great source of national wealth, will increase, without any considerable addition of unproductive consumers. Hence will arise an accumulation of the general stock and revenue of the kingdom, which will furnish large resources for supplying the exigences of the State, in respect both of internal government, and national defence,—resources not only plentiful, and at hand, but subject to none of the difficulties and uncertainties, to which those drawn from foreign territory and foreign trade, are unavoidably exposed.

Besides, Agriculture is peculiarly friendly to the health and morals of the people. The exercises, in which it employs them, are generally in the open air, and of such a nature as to render them hardy and robust; and to preserve them from those diseases, to which men employed in sedentary occupations, or confined within the noxious atmosphere of large towns, are usually liable.

And as Agriculture contributes to bodily health and vigour, so it tends to preserve innocency and simplicity of manners. At the same time that it promotes population, it obliges the people to continue in a divided and scattered state, thereby preventing that growth and prevalence of corruption, which an easy and frequent intercourse is so apt to produce. And as every day hath its particular task, which can seldom be anticipated or postponed, they have neither leisure nor opportunity allowed them for contracting habits of idleneſs and intemperance. By their situation and manner of life, they are prevented from being often witneſses to scenes of profligacy and vice, and thereby kept in a great measure free from the contagion of bad example; the frequency of which proves so destructive of the morals of the crowded city. Hard and constant labour serves to keep the paſsions in check, and affords no time for the contrivance and execution of deliberate schemes of wickedneſs. In short, as idleneſs is the first step to profligacy, so the habits of industry are highly favourable to the interest of virtue, as they keep men out of the way of those temptations, by which virtuous principles may be shaken and overthrown.

It deserves consideration, likewise, that Agriculture, when in a flourishing state, contributes greatly to the prosperity of trade and manufactures. With what superior advantage may these be carried on, when, instead of being obliged to depend upon the precarious and often expensive supplies of a foreign market, the numerous trading veſsels that crowd our ports can be completely victualled, and at the same time supplied with many valuable articles of commerce; and when the manufacturer can be furnished with a constant and plentiful supply of provisions from the produce of our own country.

Besides, as the people become more wealthy, a taste for refinement will, of course, spread and be more generally indulged. Not satisfied with bare neceſsaries, men will look out for the elegances and delicacies of life. Hence the demands upon the manufacturer and the merchant will increase; and hence fresh encouragement to activity and improvement will be derived. But the advantage will not be wholly on the side of trade and manufactures; it will return back to the farmer with interest, and be amply repaid by a ready market, and a high price for the productions of the field.

The truth is, Agriculture and Manufactures ought to go hand in hand; and a wise Government, so far as the interference of Government may be competent and proper, will study to direct their several operations, and to adjust the encouragements that may be neceſsary for their improvement and succeſs, in such a manner as to render them mutually advantageous, and jointly subservient to the general welfare.

In short, this great plan for promoting industry and agricultural improvement, if carried into full effect, will have the happiest influence on the political sentiments of the people at large. When they find themselves the objects of public attention and care; and when they see Government chalking out to them a path by which they may rise to opulence and consideration; when they experience from their masters a kind and liberal treatment; and when they find themselves protected in the enjoyment of the fruits of their honest industry, by the operation of laws wisely framed and impartially executed, they become naturally and warmly attached to their native soil, repay the friendly attention of their superiors with honour and esteem; and look up with veneration to that system of Government under which they flourish and are happy, and will be ready, in the moment of danger, to stand forth in its defence.

ESSAY II.

On the Pine-Tree.

OF this very useful GENUS of plants there are various species, all of which flower in the months of April and May. There being male and female flowers on the same plant, the male flowers are collected in conic bunches, and the females in close cones, which grow into the real cones, containing the seed. To this genus Linnæus has added the Fir-tree, the Cedar of Lebanon, and the Larch, their generic characters being the same as the Pinus. All the species, except the Larch, are evergreens. In the edition of Miller's Gardeners' Dictionary, published by the ingenious Dr. Martyn, Regius Profeſsor of Botany in the University of Cambridge, there will be found the best directions for propagating all the different species of Pines, so that in this Eſsay I shall principally confine myself to the historical account of such as are generally known.

1. *The WILD PINE, or SCOTCH FIR.*

This is called the Scotch Fir, because it grows naturally on the Highlands of Scotland, where the seeds, falling from their cones, come up and propagate themselves without any care. But it is not in Scotland only that these trees thrive naturally; for they grow spontaneously in Denmark, Norway, and Sweden. And though, from the above instances, it would seem that they delighted principally in these northern parts; yet when the plants are properly raised and planted out, no climate comes amiſs to them; for they will thrive and grow to be good timber-trees in almost any part of the temperate globe. The timber of this tree is what we call Deal, which is sometimes red, sometimes yellow, but chiefly white. The Pinaster is a variety of the Scotch Fir, and is titled Pinaster Latifolius, julis virescentibus sive pallescentibus. This tree throws out large arms, and its leaves are larger and longer, and of a paler green than those of the Scotch Fir. It is a native of Italy, though it abounds in the south of France; and in Switzerland, where there are great plenty of these trees, the inhabitants cut them into shingles for the covering of their houses, which soon become so compact and close, by the sun's melting the resinous substance, as to be proof against all weather. There are two other varieties; Pinus maritima altera; and Pinaster tenuifolius, julo purpurascente.—Bauh. Pin. The white inner rind of this tree, when dried and ground in a mill, is used by the inhabitants of some northern countries as a substitute for flour, which, after undergoing a particular operation, is converted into bread.

The valuable plantations of Firs now growing upon Crooksbury Heath, in the county of Surrey, prove to what a profitable purpose such kind of land may be applied: The Heath consists of near 3700 acres; the soil a deep sand, and covered with short heath. In 1776 twelve acres of this Heath were planted with Scotch Firs, four years old, at the distance of four feet. The ground was no ways prepared, but the holes were simply dug, and the plants put in. In 1788 the plants were thinned, being then about the height of fourteen feet, and produced eight pounds per acre. The thinnings were sold for hop-poles, and the branches were made into bavins for burning lime. Mr. Giles of Farnham, in the neighbourhood of this Heath, has for many years used no other poles than Firs for hops, and which he has found to answer full as well as Ash or Alder. Those he has at present, have been nine years in use, and at this time are perfectly sound. He has attended with much accuracy to their durable quality as applied to the purpose of hop-poles: and he finds that Larch is the best, the Weymouth Pine the next, and the Scotch and Spruce, the least durable. The second thinnings (1794) are now taking place, and the trees are converted into scantlings and rafters, being about forty feet in height. The number of trees at present standing upon the twelve acres, are computed at 18,531, and are valued at 573l.

It would appear from the hardy nature of the Fir, and the readineſs with which it grows in almost every part of this island, that it is an indigenous tree; yet Cæsar expreſsly says that it is not a native. In his description of the country, he observes that Britain had all the trees of Gaul, except the Beech and Fir: *Materia cujusque generis, ut in Gallia, præter Fagum et Abietem.* As all the British words for the Beech are clearly of Roman derivation, Faighe, Faghe, or Faydh, it is probable that it was introduced into Britain with the Roman colonies; but with regard to the Fir, the case is otherwise, for many of its names are purely British; and this is a testimony not to be overthrown. The ingenious

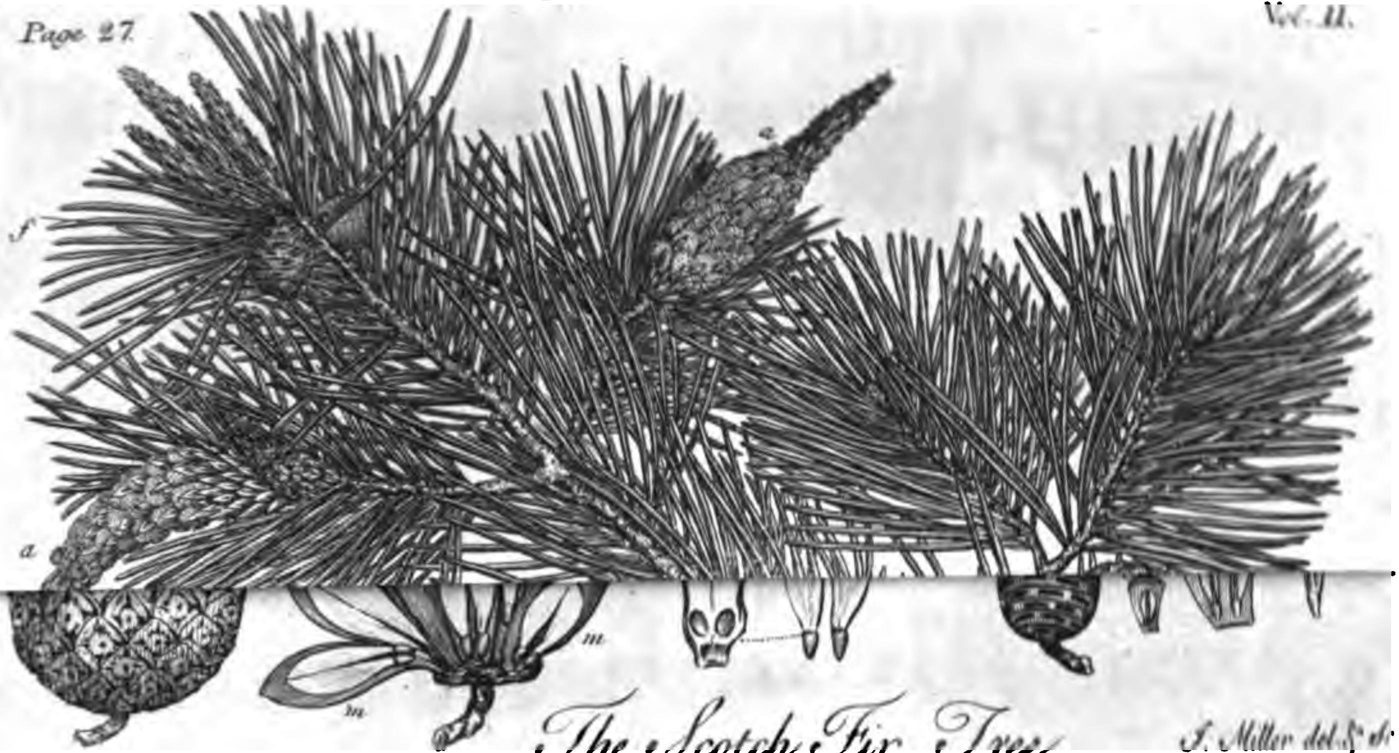
Mr. Whitaker, in the first volume of his History of Manchester, p. 309, treats this subject with great learning and precision. He says, " Among the many Roman names for " the Fir in the British language, there are " three which are purely and absolutely " British. The Scotch distinguish the Fir " by the British appellation of Gius; the " Irish, by the British appellation of Giumhus; " and the Welch, by the British appellation " of Fynniduydh. Had the Fir been originally introduced into the fields of Britain by " the Romans, all the British appropriated " appellations of it must have been, as some " of them evidently are, the mere derivatives " of the Roman Abies, Z-aban, S-ibuydh, " S-apin, and S-abin. And the existence " of one British appropriated appellation for " the Fir is a strong argument in itself that the " tree was not introduced by the Romans, " but that it was originally British.

" Firs actually appear as early as the third " century in the Unromanized regions of " Caledonia and Ireland, and appear as the " acknowledged Aborigines of the country. " Firs are frequently mentioned in the poems " of the Caledonian Bard, not as plants seen

" by him on the continent or in the provinces, " not merely as forming the equivocal imagery " of a similitude, but as actually and anciently " growing in both. The spear of a warrior, " says an Irishman in Ulster, pointing to " a neighbouring tree, *is like that blasted Fir:* " And it is compared by another to the Fir " of Slimora particularly, a mountain in the " north of Ireland. And the tomb of a fallen " warrior, upon the western shore of Caledonia, " is thus described from the reality by the " Bard: *Dost thou not behold, Malvina, a rock* " *with its head of heath? Three aged Firs* " *bend from its face; green is the narrow plain* " *at its feet.*

" The Fir is also discovered in our Mancu- " nian moſses, together with the Birch and " the Oak, as frequent as the Oak, and much " more frequent than the Birch. The Fir of " our moſses is not, as the wild hypothesis of " some aſsert it to be, a mere mimickry of the " natural Fir, merely an Oak or a Birch that, " lying for ages in the unctuous maſs, has " discharged itself of all its original properties, " and has adopted all the characteristic pro- " perties of the Fir. Had this been the case, " it could not poſsibly be distinguished from " the Oak or the Birch, and all the trees of

" our moſses must have been equally and " absolutely Firs. The Fir is the only tree of " our moſses that exhibits a resinous quality. " And the Fir of our moſses is as much " discriminated to the eye, by the peculiar " nature of its grain, as the Oak or the Birch. " Nor is this all: The Fir is perpetually dis" covered in such of our moſses particularly " as were demonstrably prior to the settle" ment of the Romans among us. It is dis" covered in such moſses as appear to the " present period actually traversed by the " roads of the Romans. It is discovered " immediately adjoining to the road, and " absolutely on both sides of it. Thus is " the Fir found very frequent in the moſs of " Failsworth, close to either margin of the " street, and mingled with Oaks and Birches. " And as the road demonstrates the moſs to " have been formed before the settlement of " the Romans at Manchester, so the trees dis" covered in the moſs must have been all " equally cotemporary with it, and all equally " with it prior to the settlement of the Romans " at Manchester. This argument carries a de" cisive authority with it: But we can pro" secute it fairly up to demonstration: The " Fir has been discovereed in our moſses, not " only in such parts as are immediately con-



The Scotch Fir Tree.

J. Miller del. & sc.

Publish'd Jan.y 1st [illegible] by A. Hunter M.D. as the Act directs

" tiguous to the Roman roads over them, but " in such as are actually occupied and covered " with the line of the Roman roads, and in " the black spongy earth immediately beneath " the Roman gravel. It has been very " recently dug up by myself under the roots " of the road over Failsworth Moſs. And " I have now in my own poſseſsion two " pieces of tried genuine Fir that were " bedded with the remains of a Birch-tree " one yard and a half in the moſsy soil, and " three yards under the crown of the Roman " gravel.

" These are three arguments which are all " sufficiently convincing of themselves: These " are three arguments which, springing from " as many different sources, all happily unite " together in one common channel, and form " together an irresistible tide of evidence. " And a fact which relates to the remotest " antiquity, and which is aſserted against the " the highest historical authority, cannot be " too powerfully demonstrated. The Fir then " was one of the trees of Britain before the " arrival of the Romans among us."

THE SCOTCH FIR. Plate 1. *a.* A male catkin. *b.* The gem, or winter lodge (Hibernaculum). *c*. The scale, or squama. *d*. A cluster of stamina. D. Ditto, magnified. *e*. A single stamen. E. Ditto, with its scale *c*, magnified. *f*. The future cone. *g*. A single scale of the cone, with its two embryos. G. Ditto, magnified. H. A single embryo, magnified. *i*. The cone. *k*. The same opened, to show how the seeds are lodged. *l*. The inner side of a scale. *m*. The two winged seeds.

2. *The WEYMOUTH PINE.*

This grows naturally in most parts of North America, where it is called the White or Masting Pine, and is one of the tallest trees of all the species; often growing a hundred feet high in these countries. Of this tree the best masts are made, and Dr. Douglaſs, in his " Historical and Political Summary of the British Settlements in North America," says, that upon the banks of the river Merimack, in the year 1736, there was cut a White Pine that was seven feet eight inches in diameter at the butt-end The bark of this tree is very smooth and delicate, especially when young; the leaves are long and slender, five growing out of each sheath; the branches are pretty closely garnished with them, so make a fine appearance; the cones are long, slender, and very loose, opening with the first warmth of the spring, so that if they are not gathered in winter, the scales open and let out the seeds. As the wood of this tree was generally thought of great service to the navy, there was a law made in the ninth year of Queen Ann for the preservation of the trees, and to encourage their growth in America; it is not much above half a century since these trees began to be propagated in England in any plenty, though there were some large trees of this sort growing in two or three places long before, particularly at Lord Weymouth's, and Sir Wyndham Knatchbull's in Kent; and it has been chiefly from the seeds of the latter that the greatest number of these trees now in England have been raised; for although there has annually been some of the seeds brought from America, yet these have been few in comparison to the produce of the trees in Kent; and many of the trees which have been raised from the seeds of those, now produce plenty of good seeds, particularly the trees in the gardens of his Grace the Duke of Argyll at Whitton, which annually produce large quantities of cones. This sort and the Scotch Pine are the best worth cultivating of all the kinds for the sake of their wood; the others may be planted for variety in parks, &c. where they make a good appearance in winter, when other trees are destitute of leaves.

3. *The STONE PINE.*

This is a tree of which there should be a few in all plantations of ever-greens. It will grow to a considerable height, and arises with a straight and fair stem, though with a rough bark. The leaves contribute to the diversifying of the scene, as they differ in colour from the other sorts, and are arranged in a different manner. The cones which it bears are large and turbinated; they strike the eye by their bold appearance when hanging on the trees, and when closely examined, exhibit a beautiful arrangement of scales. They produce a kernel as sweet to the taste as an almond, with a slight flavour of the turpentine. This tree is a native of Italy, where the kernels are served up in deserts at the table; they were formerly kept in the shops, and thought to be salutary in colds, coughs, and consumptions. The Stone Pine may be sawed into good boards, though the timber is generally allowed not to be quite so valuable as the other sorts, The colour is not the same in all trees; some exhibiting their timber of a very white colour; others again are yellower, and smell stronger of the turpentine. Martial represents it as dangerous to stand under this species of Pine, on account of the magnitude of its cones:

> Poma sumus Cybeles; procul hinc discede, viator,
> Ne cadat in miserum nostra ruina caput.
>
> Lib. xiii. Ep. 25.

4. *The SWAMP PINE.*

This is a very large growing tree, and is highly proper, as its name imports, to be planted in moist places. The leaves are long, and of a delightful green colour; three iſsue out of each sheath, and adorn the younger branches in great plenty. Its propagation is the same as the Weymouth Pine; and the planting out, and after-management, is exactly similar. It will grow on upland and dry grounds; but it chiefly delights in moist places.

5. *The CEMBRA PINE.*

The Cembra Pine is a fine tree; the leaves are very beautiful, being of a lighter green than most of the Pines, and are produced five in a sheath. They are long and narrow; and as they closely ornament the branches all round, they render the tree, on that account, very desirable. The cones also have a good effect; for they are larger than those of the Pinaster, and the squamæ are beautifully arranged. This tree is a native of the Alps, and is well described by Mr. Harte, in his elegant Eſsays in Husbandry, under the title of *Aphernousli* Pine. He considers it as a tree likely to thrive with great advantage on our bleak, barren, rocky, and mountainous lands; even near the sea, and in north, or north-east aspects, where something of this hardy kind is much wanted. The timber is large and has many uses, especially within doors, or under cover. The bark of the trunk is not reddish, like the bark of the Pine, but of a white cast, like that of the Fir. The shell which incloses the kernel is easily cracked, and the kernels are covered with a brown skin which peels off. They are about the size of a common pea, triangular, like buck-wheat, and white as a blanched almond, of an oily agreeable taste, but leaving in the mouth *that* small degree of asperity which is peculiar to wild fruits, and not unpleasing. These kernels sometimes make a part in a Swiſs desert. Wainscotting, flooring, and other joiner's work, made with the planks of the Aphernousli, are of a finer grain, and more beautifully variegated than deal, and the smell of the wood is more agreeable. From this tree is extracted a white odoriferous resin. On this occasion the curious planter may consult a very scarce book, *De Arboribus Coniferis, Resiniferis, aliisque Sempiterna fronde Virentibus*, written about two hundred years ago, by Pietro Beloni. In the plantations belonging to Jeremiah Dixon, at Gledhow, near Leeds, may be seen several of these Pines. They are there called the Gledhow Pine. This tree grows higher up the Alps than any other Pine, and is even found in elevations where the Larch will not grow.

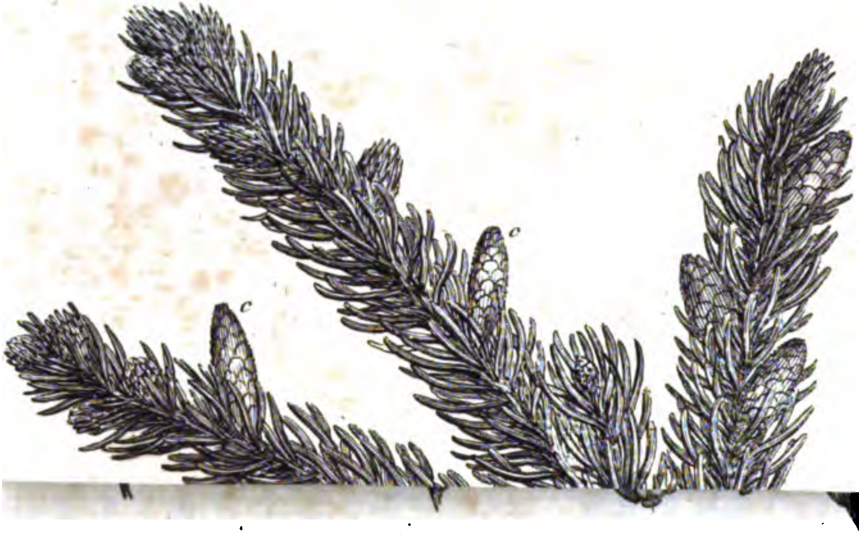
6. *The SILVER FIR.*

This is a noble upright tree. The branches are not very numerous, but the bark is smooth and delicate. The leaves grow singly on the branches, and their ends are slightly indented. Their upper surface is of a fine strong green colour, and their under has an ornament of two white lines, running lengthways on each side of the mid-rib, on account of which silvery look, this sort is called the Siver Fir. The cones are large, and grow erect; and when the warm weather comes on, they [illegible] which should caution [illegible] comes at an early season. [illegible] common in the mountainous parts [illegible] in Norway, and affords the [illegible] From its yielding pitch, it has [illegible] of *Picea*, or Pitch-tree.

[illegible] SPRUCE FIR.

[illegible] Fir is a beautiful tree, as well [illegible] for its timber, producing the [illegible] It is a native of Norway and [illegible] where it grows spontaneously, and [illegible] of the principal productions of their [illegible] It also grows plentifully in the [illegible] of Scotland, where it adorns those [illegible] mountains with a constant ver[illegible] The long-coned Cornish Fir is a variety [illegible] and differs scarcely in any respect; [illegible] the leaves and cones are larger. [illegible] of the Norway Spruce go by the [illegible] Picea major prima, sive Abies rubra: [illegible] sive foemina.

[illegible] Fir. Plate 2. *a*. A catkin [illegible] *b*. A single stamen. B. Ditto, [illegible] *c*. The future cone. *d*. A single, [illegible] two embryos. D. Ditto, mag[illegible] The embryo, with its pointal.



The Spruce Fir Tree.

Publish'd [illegible] by A. Hunter M.D. as the Act directs.

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e. Ditto, magnified. *f.* The cone. *g.* A single scale, with its two winged seeds. *h.* A seed.

8 *The CEDAR of LEBANON.*

This tree is generally supposed to be an inhabitant of Mount Libanus only, but it is now found upon Mount Taurus, Amanus, &c.; and, from its hardy nature, it may be easily naturalized to any climate.

In the garden of the old palace at Enfield, stands a Cedar of Libanus, of considerable stature. The body, exclusive of the boughs, contains about 103 cubical feet. This tree was planted by Dr. Uvedale, who kept a flourishing boarding-school in this house at the time of the great plague in 1665. It is in height about 45 feet at present, eight feet having been broken off from its top by the high wind in 1703. Several other Cedars of considerable size are scattered about in different parts of this kingdom. Of these, one of the most remarkable was blown down by the hurricane that happened on the 1st of January, 1779. It grew on the North-side of Hendon Place, eight miles from London.—The height 70 feet; the diameter of the horizontal extent of the branches, 100; the circumference of the trunk, seven feet above the ground, 16; twelve feet above the ground, 21. At this latter height it began to branch; and its limbs, about ten in number, were from six to twelve feet in circumference. This tree is supposed to have been two hundred years old, and planted in the reign of Queen Elizabeth: Tradition says by her Majesty herself. When blown down, it was perfectly sound and undecayed, and seemed as if not grown to maturity. The following are the dimensions of a fine Cedar growing at Hillington. The perpendicular height is 53 feet; the diameter of the horizontal extent of the branches from East to West, 96; from North to South, 89; the circumference of the trunk, close to the ground, 13½; seven feet above the ground, 12½; twelve feet above the ground, 14 feet 8 inches; and thirteen feet and a half above the ground, just under the branches, 15 feet 8 inches. It has two principal branches, one of which is bifid 1½ foot above its origin: Before it divides, it measures in circumference 12 feet: after its division, one of its forks measures 8½ feet, the other 7 feet 10 inches. The other primary branch, at its origin, measures 10 feet: and soon dividing, throws out two secondary ones, each 5½. Its age is supposed to be 116 years.

We do not exactly know when and by whom the Cedar was first introduced to England. Turner, one of our earliest herbalists, where he treats "of the Pyne-tree, and other of that Kynde," says nothing of it. Gerarde, published by Johnson in 1636, mentions it not as growing here; and Parkinson, in his Theatrum Botanicum, 1640, speaking of the Cedrus Magna conifera Libani, says "The branches, *some say*, all grow upright, but others, strait out." It is very certain, from what Mr. Evelyn says, that the Cedar of Lebanon was not in 1664, cultivated in England; but from the warm manner that he expreſses himself upon this head, it is probable that it soon after became an object of the planter's attention.

There are said to be a few Cedar-trees still remaining upon Mount Libanus, which are preserved with a religious strictneſs: For we are informed, from the Memoirs of the Miſsionaries in the Levant, that, upon the day of the Transfiguration, the Patriarch of the Maronites, (Christians inhabiting Mount Libanus,) attended by a number of bishops, priests, and monks, and followed by five or six thousand of the religious from all parts, repairs to these

Cedars, and there celebrates that festival which is called "The feast of Cedars."—We are also told that the Patriarch officiates pontifically on this solemn occasion; that his followers are particularly mindful of the Bleſsed Virgin on this day, because the scripture compares her to the Cedars of Lebanon; and that the same holy Father threatens with ecclesiastical censure those who presume to hurt or diminish the Cedars still remaining.

The epithet of *lofty*, sometimes given to the Cedar, is by no means just; since from the experience we have of these trees growing in England, as also from the testimony of travellers who have visited the few remaining ones on Mount Libanus, they are not inclined to be lofty, but, on the contrary, extend their branches very wide. The Psalmist makes a proper allusion to this tree in his description of the flourishing state of a people. "They shall spread abroad like a Cedar in Libanus." Had Milton been as good a naturalist as he was a poet, he would not have wrote,

> ————and over head upgrew
> Insuperable height of loftieſt shade,
> *Cedar*, and Pine, and Fir, and branching Palm.
>
> PARADISE LOST, B. IV.

nly relic of Dr. James Sherards fa- botanic garden at Elsham, is a Cedar of banon, which girts nine feet, at three feet rom the ground.

9. *The BALM OF GILEAD FIR.*

This beautiful tree is a native of North America. It rises with an upright stem, and its branches are garnished with solitary, flat, obtuse leaves, slightly emarginated at top, of a dark green colour on their upper surface, and marked with whitish lines underneath. The cones are roundish and small. The buds and leaves are remarkably fragrant, hence its name. From wounds made in this tree is obtained a very fine turpentine, which is sometimes sold in the shops for the true Balm of Gilead. It delights in a rich deep soil.

10. *The LARCH-TREE.*

This tree is a native of the Alps and Apennine mountains. It is of quick growth, and will rise to the height of one hundred feet; the branches are slender, and their ends generally hang downward. These are garnished with long, narrow leaves, which arise in clusters from one point, and spread open above like the hairs of a painter's brush; they are of a light green, and fall in autumn, like other deciduous trees. In the month of April the male flowers appear, which are disposed in form of small cones; the female flowers are collected into oval obtuse cones; these in some kinds have bright purple tops, and in others they are white. These differences, however, are accidental, as the seeds taken from either of the varieties will produce plants of both sorts. The cones are about one inch long, and obtuse at their points; the scales lie over each other, and are smooth; under each scale two winged seeds are generally lodged. It is remarked that those trees which have been planted in the worst soils, and most exposed situations, have thriven the best, which is a great encouragement. At Rufford, the seat of the late Sir George Savile, there are large plantations of Larch upon a blowing sand, in which situation they far outstrip every other kind of tree. Some trees cannot bear too great a luxuriancy, and the Larch, in particular, is apt to grow top-heavy from much shelter and nourishment: They should therefore be planted in clumps, and not as single trees; neither should the plants be taken from very warm nurseries, if intended to be placed out upon exposed situations, but rather raised as near the spot as poſsible, taking care that the soil be good. When they are intended to grow large, they should not exceed three or four years when planted; for though trees of a greater size will remove very well, yet experience has shown us that the youngest trees, with good roots, bear change of situation the best. The Larch is a tree not sufficiently known in this kingdom; but there is great reason to apprehend that it will soon prove a very important acquisition to the planter. In Switzerland they cover the roofs of their houses with shingles made of Larch. These are generally cut about one foot square, and half an inch in thickneſs, which they nail to the rafters. At first the roof appears white, but in two or three years it becomes as black as coal, and all the joints are stopped by the resin which the sun extracts from the pores of the wood. This shining varnish renders the roof impenetrable to wind or rain. It makes a cheap covering, and, as some say, an incombustible one; but that is rather doubtful. From this tree is extracted what we erroneously call *Venice Turpentine.* This substance, or natural balsam, flows at first without incision; when it has done dropping, the poor people, who wait on the Fir-woods, make incisions, at about two or three feet from the ground, into the trunk of the trees, and into these they fix narrow troughs, about twenty inches long. The end of these troughs is hollowed like a ladle; and in the middle is a small hole bored, for the turpentine to run into a receiver, which is placed below it. As the balsam runs from the trees, it paſses along the sloping gutter, or trough, to the ladle, and from thence runs through the hole into the receiver. The people who gather it visit the trees morning and evening, from the end of May to September, to collect the turpentine out of the receivers. When it flows out of the tree, the turpentine is clear, and of a yellowish white; but, as it grows older, it thickens, and becomes of a citron colour. It is procured in the greatest abundance in the neighbourhood of Lyons, and in the valley of St. Martin, near Lucern, in Switzerland. At an early age, this tree makes posts and rails, more durable than Oak, and when used as piles, it does not seem to suffer any decay after a long period of years.

The scales of the Larch cones are so closely glewed together, that it is with the greatest difficulty we can separate them without bruising the seeds, which renders them unfit for vegetation. It is on this account that little good seed can be procured from the wholesale dealers. Mr. Speechly, gardener to his Grace the Duke of Portland, has communicated to me the following method of raising Seedling Larches, which at once obviates all the difficulties complained of, and secures to the planter a certain crop at a moderate expense.

"Let the cones be collected in the month of November, or beginning of December, and when gathered, lay them in heaps about six inches thick, in a shady, but exposed situation, taking care that the heaps be not too large, which would occasion mouldineſs. In this manner let them be exposed to the weather till the beginning of May, which is the properest season for laying them upon the beds, as there is not power in the sun before that time to cause the cones to expand sufficiently. Then let beds of four feet in breadth be prepared on ground newly dug; a rich, light, and sandy soil, is the most proper. The mould should be raked from the middle to the sides of the beds, so as to form a kind of ridge on each side, to prevent the cones, or their seed, from falling into the alleys, which should be two feet in breadth for the convenience of the weeders. The beds being thus finished, the cones should be so disposed, that every part of the surface shall be covered; and if a few cones are dispersed upon the others, the seeds will be shed with greater certainty. If the weather comes warm and dry, the cones will soon expand, so that it will be proper to examine the beds frequently, to see when a sufficient quantity of seed is shed. The cones may then be removed to a second bed, prepared in the same manner as the former; but before they are taken off, it will be proper to give them a shake in a coarse sieve, which will occasion a considerable quantity of seed to fall from them, especially if this operation be performed in the middle of the day, for the morning and evening dews contract the cones, and prevent their parting with the seed. As soon as the cones are removed from the beds, let the seed be covered with a little fine mould, which should be sifted about a quarter of an inch thick over every part. Should the weather become hot and dry, a few gentle waterings will greatly promote the growth of the young plants. After this, nothing more will be required but keeping the beds clear of weeds. The cones may be removed from the second to a third bed, and great ſucceſs has even been had upon a fourth bed. No time can be fixed for the laying of the cones upon the beds; it depends entirely upon the dryneſs and warmth of the weather."

And here it will be neceſsary to remark, that a plentiful stock of seed is absolutely neceſsary, in order to obtain a full crop of plants; for when these stand thin on the ground, they are very liable to be thrown out by the frost in the first winter. A full crop should rise like a brush; the roots will then be matted together, forming a tough bed that will resist the severest winter. Plants raised in the manner here recommended, rise with greater vigour than those sown in the common way; from which it appears that the seed of the Larch, and probably of all the Pine tribe, decreases in its vegetative power, after it has been taken from the cones.

11. *The CANADA SPRUCE FIR.*

This is a native of North America. It grows on the mountains and higher lands, and arrives at a considerable size. The varieties are: The White Canada Spruce, the Red Canada Spruce, and the Black Canada Spruce. These only differ in the colour of their cones, which are small.

The best season for sowing the seeds of Pines, is about the end of March; and when the seeds are sown, the beds should be covered with nets, otherwise when the plants begin to appear, with the husk of the seed on their heads, the birds will pick them off and destroy them.

ESSAY III.

On the Action of Lime and Marl as Manures; and making of artificial Marl for the Purposes of Agriculture.

THE principles on which different manures produce advantages, in the soils to which they are applied, seem to claim a more particular investigation than the subject has hitherto received. A very ingenious writer* has indeed made great advances in these interesting researches; yet it is apprehended much still remains undone, and the inquiry is truly worthy of all the elucidation which can poſsibly be procured.

Manures have been supposed to act, either by adding nourishment to the soil; by preparing the nourishment, which it already contains, for the digestion of the plants; by enlarging the vegetable pasture of the soil; or by attracting the food of plants in greater plenty from the air.

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* Home's Principles of Agriculture and Vegetation; a work well deserving the attention of every philosophical farmer.

Under the second of these heads are placed those manures, which, as they are not supposed themselves to afford nutriment, are suspected of exhausting the soil, by too hastily reducing the putrescible matter into mucilage; and thus, though greater crops be at first produced, leaving the land in a weaker state than it was in before the reception of the aid afforded by these transient auxiliaries.

Lime is, in general, claſsed among these forcing manures, perhaps with some degree of injustice. It is probable that lime may afford food to plants, by the salts it may form in conjunction with the acids with which it may meet. Its effects will doubtleſs be more or leſs durable, in proportion to the nature of the land on which it is laid *. On stiff clays, the effects of forcing manures will be much more permanent, than on light sandy soils. Something may likewise depend on the state in which lime is used.

Lime is calcareous earth deprived of its

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* For a particular account of the effect of lime on different soils, see Mr. Young's Tour through the East of England, Vol. IV. p. 394, &c. See also Home's Principles of Agriculture, p. 58.

fixed air * and water, but which has acquired in its calcination a considerable proportion of fire, as is apparent from the great heat, and even ignition attending the slaking of lime with water, and its solution in acids †.

How far this last principle may be advantageous to lime as a manure, is well deserving the inquiry of the practical farmer; whether, when applied to dry, light soils, it may not be prejudicial, by increasing the property of calcareous earth to attract to itself and retain the moisture of the soil, and by even *evaporating* too much of its water, till the extinction be completed. The evaporation of water, in the slaking of lime, is surprisingly great; besides which, the lime obstinately retains a considerable portion, viz. one-fourth, or one-fifth of its weight, of the water employed in the proceſs, though dried in a conſiderable degree of heat. It may, perhaps, also prove injurious, by too quickly rendering the oily parts of the soil miscible with water, and thereby expending them too fast.

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* Fixed air enters into the composition of many bodies in which it remains in an unelastic state. It is the vapour which escapes from fermenting substances, and is let loose from alkaline salts, or calcareous earth, by the addition of acids, occasioning that brisk motion in them which is called effervescence. It may also be discharged from these bodies by the action of fire.

† Vide Opuscules Physiques et Chymiques, par M. Lavoisier, Tome premier, p. 214; or Henry's Translation of the same book, p. 232.

On the other hand, the fiery particles contained in quick-lime may be of singular service in cold wet land, by promoting the diſsipation of part of the water, by afterwards absorbing and condensing other parts of it, and by more forcibly decompounding the aluminous and metallic salts which are often contained in such grounds. It may also be useful in destroying rushes and other weeds, and by burning the smaller fibres of the graſs or corn roots, may make the plants more strong and healthy.

It may admit of some doubt, however, whether calcareous earth, in its reduction to the state of quick-lime, be not deprived of another principle which may have great use in vegetation. Some manures, as has been before observed, improve land by enlarging the vegetable pasture, viz. by breaking down and attenuating the soil, and thus giving room for the roots to spread out in search of nourishment, and for the nutritious juices to percolate more freely. This property in manures depends on their disposition to ferment; and hence it is that dung should always be laid on the land before the proceſs of putrefaction has proceeded too far. This is contrary to the practice of that excellent farmer, Mr. Bakewell, and I should therefore have been very diffident in embracing an opinion opposite to his, if I had not found it supported by many writers on agriculture; Mr. Young in particular blames Mr. Bakewell's manner, in suffering his dung to lose all its moisture, and the body of it to become powder like snuff, before he applies it. Though he acknowledges it to be very strong, yet the diminution in quantity, says he, will make it nearly resemble a rich top-dreſsing of soot, which has a moderate effect for only one crop *. But is there no reason to suspect that the whole advantage arising from fermentation in manures, is not due to the mere mechanical effect produced by the intestine motion, in destroying the cohesion of the earthy particles? Is there not something discharged during this

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* Farmer's Tour through the East of England, Vol. IV. p. 449.

proceſs which may be abſorbed by the roots of the plants, and afford them nutriment and ſupport? It is well known that both in the vinous and putrefactive fermentation, much fixed air is diſengaged, and it is certain alſo that this kind of air is contained in conſiderable quantity in moſt vegetables.

But the ſubſequent facts ſeem to place the doctrine which has been here advanced on a more firm foundation than that of conjecture. Dr. Percival made a number of very intereſting and entertaining experiments, the laſt ſpring, on the influence of fixed air on vegetation; and his trials ſeem to evince that it affords actual nouriſhment to plants, and continues life in them, a conſiderable length of time, without any other ſupport. The following experiment he has ſelected, at my deſire, from many others which furniſh a ſimilar concluſion.

" Tueſday, April 18th, 1775; A ſprig of " mint was ſuſpended, with the root upwards, " in a veſsel of fixed air *. The ſucceeding

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* As this experiment was made in Dr. Nooth's machine, there muſt neceſsarily have been a quantity of common air mixed with the fixed air. Plants confined in veſsels of pure fixed air, die.

ant as when first
ollected at the
same bed, which
was quite withered.
y, a curve was formed
the stalk, and the top of
risen about an inch perpen-
wards the mouth of the veſsel.
, the mint continued to grow and
nd, looked vigorous and fresh: The
which was very small appeared quite
ry so that the nourishment, probably, was
“ imbibed by the leaves. Tuesday, having
“ been absent two days, the plant was not
“ supplied with fresh streams of air: It was
“ still in vigorous vegetation. Friday, the
“ eleventh day of the experiment, the plant was
“ taken out. It was perfectly fresh, but whilst
“ it lay on my study table the leaves grew soft
“ and flaccid, and in leſs than six hours it seemed
“ to be withered. The mercury in Fahrenheit's
“ thermometer, during the course of this ex-
“ periment, stood from 60 to 69 degrees in
“ the shade and open air, at two o'clock in
“ the afternoon.”

It also appears from Dr. Hales's experiments, that air enters in considerable quantity into plants, not only with the principal fund of nourishment by the roots, but also through the trunks and leaves, and is likewise mixed with the earth both in an elastic and unelastic state.

The analogy between animal and végetable nutrition likewise tends to confirm this theory. A great quantity of this elastic fluid is disengaged from the aliment in the stomach and bowels, during the progreſs of digestion, and though, when from a weakneſs of these organs, it is accumulated in too great quantity, it may degenerate into disease, yet there is but little doubt of its great utility in the animal economy, in giving tone and vigour to the fibres, and checking the tendency to putrefaction inherent in all animal bodies: nay, it has even been supposed, by some philosophers, to be the bond of union, the cement by which the elementary particles of bodies are combined.

Now calcareous earth or lime-stone, before calcination, or when it has been exposed to the open air for several months after that operation, contains this fixed air and water to the amount nearly of one half of its weight *: When laid on land, in this state, it gradually attracts the acid contained in the earth as well as that of the air; in uniting with it an effervescence is produced, which will be in proportion to the quantity and strength of the acid either sudden and violent, or moderate and long continued. The latter will generally be the case, and is more desirable, as, by the gentle but constant agitation, the earth will be kept continually loose, and from the slow detachment of the fixed air, the roots of the plants will more effectually absorb it, without an useleſs expense of it being suffered †.

Marl is generally allowed to be, when properly applied, a very lasting improvement.

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* It appears from the ingenious Mr. Lavoisier's experiments, that one hundred pounds weighs of chalk contains about thirty-one pounds fifteen ounces of fixed air, fifteen pounds seven ounces of water, and fifty-two pounds ten ounces of alkaline earth. *Opuscules Physiques et Chymiques, par M. Lavoisier, Tome premier, p.* 213.—Henry's Translation, p. 251.

† On this account, when applied to corn land, this manure should not lie too long exposed to the air before it be ploughed in.

Mr. Young mentions instances of its continuance for forty and fifty, and, of one species, even for an hundred years. The nature of this manure is clearly ascertained by the ingenious Dr. Ainslie, in the sixteenth Eſsay of the first Volume of these Eſsays. By his experiments we are not only made acquainted with the component parts of marl, but the farmer is also taught to determine the different proportions of these parts in different marls; a knowledge of great importance, as he will hereby be enabled to judge with precision of the quantity to be applied, according to the contents of the marl, and the nature of the land intended to be improved.

We learn from these experiments that marl consists of calcareous earth, clay, and sand, mixed in various proportions in different parcels of that manure. The first of these substances is involved, as it were, in coatings of the clay. May not this covering, by defending it from the sudden action of the acids contained in the ground, and preventing the too rapid effects of the calcareous earth itself on the putrescent and oily matter of the soil, account for the greater permanency of this compound than of calcareous earth alone, either in a caustic or mild state? For though it appears from Dr. Ainslie's experiments, contrary to the impudent aſsertions of an advertising quack in agriculture, that marl does not form any salt with the acid of the air, even from long exposure to the atmosphere, yet it is probable that when powdered and mixed with the soil, it will not only unite with the acid which it may find there, but also attract it from the circumambient air.

But a more important benefit arising from Dr. Ainslie's analysis, has perhaps been hitherto overlooked; I mean the artificial composition of marl for the purposes of agriculture; and I trust that the scarcity of this substance in some countries will be a sufficient apology for my soliciting the attention of the public to the subject. Mr. Young relates, "that the farmers in Fleg-hundred, bring it from Norwich "to Yarmouth by water, and then from four "to eight miles by land, at the expense of "seven shillings and four-pence per cart load; "and that in the neighbourhood of Colchester "they give, after it has been brought from "Kent by shipping, from 7s. to 9s. a load "for it, and carry it even ten miles*."

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* Young's Farmer's Tour through the East of England. Vol. IV. p. 403.

Artificial composts, of different kinds, have long been used in agriculture, but no attempt has been made to introduce the use of artificial marl. Though the ingenious experimentalist above-mentioned, has demonstrated of what materials the constituent parts of marl consist, though he even proceeded to make factitious marl for the purposes of chemical experiments, yet the idea does not seem to have occurred to him, nor, as far as I can find, to any other person, of bringing the use of it into actual practice. Many countries which contain no marl, have sufficient plenty of clay, and the farmer may likewise often procure lime or chalk at an easy expense; the third ingredient, though of leſs importance, and not always found in marls, is to be met with in almost every country. Clay, by the addition of water, becomes soft and ductile; in this state it may easily be mixed with any portion of chalk or of effete lime *, and a due quantity of sand.

Let a floor of brick be laid, as for the preparation of mortar, on this let the clay be suf-

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* Lime is said to be effete when it has recovered its air and water.

ficiently moistened, and then a proper quantity of calcareous earth and sand be well incorporated with it by treading or by wooden stampers. When this is completed, let it be thrown aside, and another parcel compounded in the same manner *.

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* Since this Eſsay was read before the Agriculture Society of Manchester, as I was travelling between Bradford and Halifax, I was driven, to take shelter from a violent storm, into the stable of a labouring farmer, who was loading his cart with dung. The nature of his employment induced me to ask him some questions relative to manures, and among others whether the country produced any marl. To this he answered in the negative, but informed me that clay was procurable, and that there was plenty of lime. On my telling him that from these ingredients he might make marl, I was not more surprised than pleased to find that he was well acquainted with the fact, and that he had actually executed what I had only surmised to be practicable. He said, that about eight or ten years since, he had made artificial marl, by throwing, alternately, layers of lime and clay, and then exposing the heap, during the winter, to the weather; by which means it mouldered down, and became a sufficiently uniform maſs. At the proper season it was laid on the field, which produced, the ensuing year, a most excellent crop of wheat. When we consider the solvent power which is so eminently poſseſsed by quick-lime, this mode of producing an union between the calcareous and argillaceous earths will appear very feasible, and will be attended with much leſs labour and expense than that which I had proposed.

This may at first appear a difficult operation, but it will seem leſs so, when it is considered, that the quantity of clay and sand together, in good marl, is not large, in some one-third, in some one-fifth, and in others not above one-sixth or one-seventh of the whole maſs. Mechanical invention may doubtleſs point out methods of expediting and rendering the proceſs more convenient, and such as may be within the reach of common farmers.

The clay used for this purpose should be as free from metallic impregnations as poſsible. If it contain too great a quantity of iron, it will appear by the high degree of redneſs which it will acquire by calcination; if vitriolic or aluminous salts, the metallic or earthy parts may be discovered by adding to the water, in which the clay has been digested, a solution of salt of tartar or pot-ash, which will precipitate the basis of the salt, if of iron, in a brown ponderous powder; if aluminous, in a white or greyish earth.

The lime, that we may come nearer to nature in our imitation, should not only be slaked, but be exposed to the open air, and often turned for several months, that it may

requires a long series of
whole of which it
cination *.

it may, if thought proper, be
aſses of a convenient bulk to be
on the ground, and heaped up to
revious to its being carried to the field.
this method, much may be saved in the weight of the carriage, if the marl be to be conveyed to any distance from the place where the mixture is formed.

The marl may also be compounded of different proportions of clay, calcareous earth, and sand, according to the nature of the land to which it is to be applied. To light or sandy land, a greater quantity of clay will be pro-

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* I find that Dr. Home thinks that lime produces little effect on vegetation till it is become effete. It may be known to have recovered its air by its no longer forming lime water, and by effervescing violently with acids without growing hot. If, however, the method described in the last note be used, it will be sufficient if the lime be fallen, without waiting for the recovery of its air; as this point will be acquired during the long time which the mixture is to be exposed to the action of the atmosphere.

per; to stiff strong land, more calcareous earth and sand; and to very strong clay it may be sufficient to apply a mixture of calcareous earth and sand with little or no clay.

Upon the whole may we not conclude, that lime, in most cases, is a stronger manure, when it has recovered the air of which it has been deprived in calcination, than it is when brought fresh from the kiln; and that when procured for the purposes of agriculture, its efficacy and permanency will in general be increased, by mixing it, in its effete state, with the other ingredients which enter into the composition of marl?

ESSAY IV.

On raising the Pine-Apple by Oak Leaves instead of Tanners Bark.

I Presume that the leaves of the Oak abound with the same quality as the bark of the tree; therefore, the sooner they are raked up after they fall from the trees, the better, as that quality will naturally decrease during the time they are exposed to the weather. After being raked into heaps they should immediately be carried to some place near the hot-houses, where they must lie to *couch*. I generally fence them round with charcoal-hurdles, or any thing else, to keep them from being blown about the garden in windy weather. In this place we tread them well, and water them in case they happen to have been brought in dry. We make the heap six or seven feet in thickneſs, covering it over with old mats, or any thing else, to prevent the upper leaves from being blown away. In a few days the heap will come to a strong heat. For the first year or two that I used these leaves, I did not continue them in the heap longer than ten days or a fortnight; but in this I discovered a considerable inconvenience, as they settled so much when got into the hot-house as soon to require a supply. Taught by experience, I now let them remain in the heap for five or six weeks, by which time they are properly prepared for the hot-houses. In getting them into the pine-pits, if they appear dry, we water them again, treading them in layers exceedingly well till the pits are quite full. We then cover the whole with tan to the thickneſs of two inches, and tread it well till the surface becomes smooth and even. On this we place the pine-pots in the manner they are to stand, beginning with the middle row first, and filling up the spaces between the pots with tan. In like manner we proceed to the next row, till the whole be finished; and this operation is performed in the same manner as when tan *only* is used.

After this, the leaves require no farther trouble the whole season through, as they will retain a constant and regular heat for twelve months without either stirring or turning; and if I may form a judgment from their appearance when taken out, (being always entire and perfect) it is probable they would continue their heat through a second year; but as an annual supply of leaves is easily obtained, such a trial is hardly worth the trouble of making.

After this, the Pines will have no occasion to be moved but at the stated times of their management, viz. at the shifting them in their pots, &c. when at each time a little fresh tan should be added to make up the deficiency arising from the settling of the beds; but this will be inconsiderable, as the leaves do not settle much after their long *couching*. During the two first years of my practice, I did not use any tan, but plunged the pine-pots into the leaves, and just covered the surface of the beds, when finished, with a little saw-dust, to give it a neatneſs. This method was attended with one inconvenience; for by the caking of the leaves they shrunk from the sides of the pots, whereby they became exposed to the air, and at the same time the heat of the beds was permitted to escape.

Many powerful reasons may be given why Oak leaves (for I have not tried any other kinds) are preferable to tanners bark.

First, They always heat regularly; for, during the whole time that I have used them, which is near seven years, I never once knew of their heating with violence; and this is so frequently the case with tan, that I affirm, and indeed it is well known to every person conversant in the management of the hot-house, that Pines suffer more from this one circumstance, than from all the other accidents put together, insects excepted. When this accident happens near the time of their fruiting, the effect is soon seen in the fruit, which always comes ill-shaped and exceedingly small. Sometimes there will be little or no fruit at all; therefore gardeners who make use of tan *only* for their Pines, should be most particularly careful to avoid an over-heat at that critical season—the time of *showing* fruit.

Secondly, The heat of Oak leaves is constant, whereas tanners bark generally turns cold in a very short time after its furious heat is gone off. This obliges the gardener to give the tan frequent turnings in order to promote its heating. These frequent turnings (not to mention the expense) are attended with the worst consequences; for by the continual moving of the pots backwards and forwards, the Pines are exposed to the extremes of heat and cold, whereby their growth is considerably retarded; whereas, when leaves are used, the Pines will have no occasion to be moved but at the time of potting, &c. The Pines have one particular advantage in this undisturbed situation; their roots go through the bottoms of the pots and mat amongst the leaves in a surprising manner. From the vigour of the plants, when in this situation, it is highly probable that the leaves, even in this state, afford them an uncommon and agreeable nourishment.

Thirdly, There is a saving in point of expense, which is no inconsiderable object in places where tan cannot be had but from a great distance, as is the case, here; the article of carriage amounting to ten shillings for each waggon-load. Indeed, this was the principal reason that first induced me to make trial of leaves.

My last ground of preference is the consideration that decayed leaves make good manure; whereas rotten tan is experimentally found to be of no value. I have often tried it, both on sand and clay, also on wet and dry lands, and never could discover, in any of my experiments, that it deserved the name of a manure; whereas decayed leaves are the richest, and, of all others, the most suitable for a garden. But this must only be understood of leaves after they have undergone their fermentation, which reduces them to a true vegetable mould, in which we experimentally know that the food of plants is contained—but whether that food be *oil*, *mucilage*, or *salt*, or a combination of all three, I leave to philosophers to determine. This black mould is, of all others, the most proper to mix with compost earth, and I use it in general for Pines, and almost for every thing that grows in pots. For flowers, it is most excellent. The remainder of this vegetable mould may be employed in manuring the quarters of the kitchen-garden, for which purpose it is highly useful.

Leaves, mixed with dung, make excellent hot-beds—and I find that beds compounded in this manner preserve their heat much longer than when made entirely with dung. In both cases the application of leaves will be a considerable saving of dung; a circumstance very agreeable, as it will be the means of preventing the contests, frequently observed in large families, between the superintendant of the gardens, and the directors of the husbandry.

ESSAY V.

On Buck Wheat.

BUCK WHEAT is an object of husbandry in a threefold light. It is propagated

1. As Grain;
2. As Manure;
3. As Green Fodder.

However, the main intention of its propagation, whether as a crop, or as a melioration of the soil, or as a green provender for cattle, being the same, namely, the cleansing of foul land, it will be convenient to keep the three objects in nearly the same point of view.

Soil.

Buck Wheat is sown indiscriminately on all kinds of Soil, but poor land has the preference: indeed it is to this species of soil that it seems most especially adapted.—Hence it is that in the most sandy lands about Berlin, particularly between Werneiche and Welsickendorff, Lewenberg, Steinbeck, and Wollenberg, so far as to the forest about Freyenwalde, this grain is cultivated to the greatest advantage.

Preparation of the Soil.

The Land, as it is generally a foul stubble, ought to receive, as soon as the hurry of wheat-sowing is over, a good ploughing before the winter sets in, and to be left in the rough state through the winter, that it may partake of the benefits of snow and frost; care should be taken to make clean and deep furrows between the ridges, and, where neceſsary, croſs furrows, with proper judgment, according to the situation of the land, in order to prevent the bad consequences of standing water. As soon as the very important busineſs of sowing the spring crops is over, this land ought to be rolled and repeatedly well harrowed, in order to bring the rubbish to the top, and which when freed from the adhering soil, ought to be either burnt in gathered heaps upon the spot, or carried off from the land. Another ploughing and good harrowing will prepare the land for sowing.

Time of Sowing.

Buck Wheat should never be sown before the beginning of June; as it has been generally observed, that if it be sown so early as to come into bloſsom before Midsummer, the bloſsoms suffer much by the blight. I am not a sufficient Naturalist to be able to account for this, only I can say with certainty that I have been so informed by the most experienced farmers as well in Germany as in England. Besides, it being a tender plant on its first appearance, the frosty mornings of the month of May, frequently destroy it in one night. Another good reason for not sowing too early is, that, if intended for green fodder, it may come into bloſsom at that time which (particularly for the dairy farmer) is often the most distreſsing in all the year; viz. the month of July, when the prime of the graſs is gone, the vigour of the vegetation spent, and the pastures frequently quite burnt up by heat.

An opportunity of a gentle shower should be taken for sowing the seed, and it will show itself above ground in six or seven days; and as this grain vegetates very rapidly, it will soon cover the whole surface of the land, and thereby prevent the coming up of weeds.

The usual quantity of seed is from eight to ten pecks per acre, but herein the farmer ought to be guided by circumstances. If the land has sufficient moisture to bring on a quick vegotation, this quantity is certainly sufficient; but if it should happen to be a very dry time, three or four pecks more ought not to be an object of consideration, because in this case some seed will be lost in the ground by not vegetating at all, and some by the pilfering of pigeons, crows, and pheasants, these birds being exceedingly fond of this grain. In the year 1795, which was uncommonly dry, I sowed four bushels per acre; and had reason to applaud myself for this seeming prodigality.

Buck Wheat gets to perfect maturity at the same time with other grain, and therefore takes its turn for harvesting with the other crops; only as it is very apt to heat, the farmer ought to be careful not to carry it home till the stalk, which is very succulent, is perfectly dry. I should always recommend, instead of putting it into a barn, to stack it into a rick, and to lay bush faggots horizontally at proper distances between it, in order to give vent to the heat.

When winter-thrashing comes on, this grain is the fittest to begin with, as its straw is only good for litter in the farm-yards, and will be a saving of straw, which can be more usefully applied for other purposes.

The Application of Buck Wheat.

The application of Buck Wheat is to be considered in a three-fold light:

1. As Grain;
2. When it is sown for Manure;
3. When it is intended for Green Fodder.

1. Application of the Grain.

Buck Wheat ought to be applied 1. *As food for man.*

If it has been got up at harvest perfectly dry, and kept from heating, it produces plenty of very good flour, though certainly not quite so white as wheat flour. I have treated myself, in my younger years, with many an excellent tart and cake made of it. But more generally it is used for making porridge. The better sort of people in Germany have it managed by the miller, in the same manner as barley is dreſsed for making what is called pearl or French barley. In this shape it appears frequently at gentlemen's tables, and is eaten with pleasure. But persons who are not so over-nice as to have their appetite taken off by the sight of a few brownish husks, merely break the grain as it comes from the flail by means of a hand-mill with which every house in the country is provided, and then it wants no other art of cookery than to boil it in water, with a little salt, till it is pretty stiff; and then it is eaten with milk, or melted butter poured over it. Prepared in this plain and cheap manner, it certainly constitutes three parts out of four of the daily food of millions of people in Germany. All who have been in the Electorates of Brandenburgh and Saxony, and in the Dukedom of Silesia, must have been struck by the appearance of vigour, and strong constitutions, in the country people of both sexes, all of whom have been brought up with Buck Wheat, and continue to make daily their three hearty meals of it, by which they are enabled to go cheerfully through more hard work than would appear credible, or even poſsible, to any English farming servant or dairy maid. For children, likewise, it proves an exceeding pleasant and nourishing food, of easy digestion, and is very frequently used in the nurseries of families of the first distinction there.

The comparative cheapneſs of this grain, ought, in justice, to be an additional recommendation of it. In the late time of scarcity, when wheat was sold at 12s. per bushel, or more, the market-price of Buck Wheat was from 4s. to 4s. 6d. What an enormous saving would it have been to the nation, as well as to individuals, if the cultivation of the latter had been more common in this country, and the generality of the inhabitants could have been reasoned out of their prejudices, and persuaded to make use of this grain as a substitute for wheat. I am certain that one bushel and a half of Buck Wheat, properly managed, will at least go as far as one bushel of wheat.

If the distillers in this country would give this grain a fair trial, they would find a great advantage in it. I know from the very best authority, that at Dantzic, a place famous for its cordials, a very great quantity of Buck Wheat is consumed by the still. Last year, a gentleman in the East-Riding of Yorkshire disposed of a considerable quantity of Buck Wheat to the London distillers, at the price of barley.

2. *As food for animals,* this grain is pretty well known in some part of this country, but no where better than in the county of Norfolk. It is a very quick, and the most econo-

mical way of fattening pigs, turkies, and all kinds of fowls. It ought to be broke in a mill, in order to prevent its paſsing undigested. When given whole to pigs, a few oats ought to be mixed with it, that they may grind it the better. The first day it is given to pigs, it has the particular effect to put them in a state of intoxication, which they show by running and tumbling about, squeaking, and rising up against the walls: it therefore ought not at first to be given in too large a quantity. The only objection against this food I ever heard, is that the fat is not so solid as that which is raised by other grain, and wastes too much away in boiling or roasting: but this it is very easy to prevent, if care be taken to feed the pigs the last eight or ten days with ground peas, and turkies or other fowls with barley; by which management it will be found that the bacon or fat will be as solid and pleasant as poſsible, and the meat much more succulent than that produced by any other sort of grain.

No kind of food is more alluring to pheasants than Buck Wheat. The best provision that can be made for them for the winter, is to take a waggon or cart load of it unthrashed, and to lay it in different heaps in

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wn, and the plough to follow the
For the purpose of covering it per-
with a sufficient quantity of soil, so that
a stalk may be seen above ground, I have
ound, as in many other instances, the coulter
with a skimmer affixed to it, an invention
of that great Agriculturist, Mr. Ducket, of
Esher, in Surry, to be of the greatest utility.
After ploughing, the soil ought to be rolled

down, in order to close the seams between the furrows, to keep out the drought; and it is the best way to roll down at least every day's ploughing before night. The land is then left undisturbed until the time for wheat-sowing comes on; for the succulent state in which the Buck Wheat has been ploughed, together with the warmth of the soil with which it has been covered, will not fail to bring on that degree of fermentation which is requisite to convert vegetables into rich manure. When the time for sowing this land with wheat arrives, it will require no further ploughing, the land having been sufficiently pulverized by the preceding ploughings, and kept, by the fermentation of the Buck Wheat, in such a mellow state, that it is perfectly fit for receiving the seed. A gentle harrowing will be found sufficient to eradicate the few weeds that may have sprung up since the land was stirred the last time. If the seed is to be put in by means of dibbling, the land ought to be made level after the harrow with a light barley roller; but I should recommend in preference the use of that most excellent implement in husbandry, Mr. Ducket's five-shared drill plough, which makes the drills at nine inches distance. The seed is sown by

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pastures in search of food, (which at that time of the year is often very scanty) they would be teazed by flies and other insects, be running about and heating themselves, and instead of increasing their milk, would shrink from it every day more and more. Whoever will make the experiment, will certainly be most agreeably surprised by the great quantity of excellent rich milk his cows will produce, at a time, when all his neighbours, who have not been so provident, will complain of the considerable reduction of theirs.

To convince my readers what a profitable fallow crop Buck Wheat is, (for as such it always ought to be considered) I give from my own experience the following instance:

In the year 1795, (the last year in which I was so happy as to be a farmer in Norfolk) I had six acres and a half, of rather foul oat stubble, sown with twenty-four bushels of Buck Wheat. The weather at the time of sowing was exceedingly dry, and continued so for more than a month:—thereby a great deal of the grain was lost; partly by not coming up at all, and partly by the depredations of my neighbours' pigeons; so that it could not be reckoned, after it came up, for more than half a good crop. In the middle of July I begun to mow part of it, viz. two acres and a half, for green fodder; and four acres were left for grain. The two acres and a half mown green, maintained twenty cows, one bull, two mares with sucking foals, and about thirty-five pigs, for five weeks; and the produce of the four acres was thirty-five coombs of grain. The produce and advantage of this but indifferent crop is as follows:

	£.	s.	d.
20 cows and 1 bull, feeding 5 weeks, at 2s. per head, - - - -	10	10	0
2 mares and foals, 5 weeks, at 2s. 6d. per mare and foal, - - - -	1	5	0
35 coombs of grain, at 18s. per coomb,	29	10	0
Total £	41	5	0
Deduction for 6 coombs of seed, -	5	8	0
Remains Clear Profit, £	35	17	0

or 5l. 10s. 4d. per acre

The feeding of the pigs has not been stated to account, as they eat only the offal;—and for ploughing, harrowing, and rolling, no deduction can be made, because the land would have required the same labour, had it been a thorough summer fallow.

Management of the Land after the Crop has been got-off.

When the land has stood for Grain, the stubble ought to be ploughed immediately; for as the Buck Wheat ought to lay till it is perfectly dry, a good deal of grain will be shelled upon the land: this would, if not destroyed before the land is sown with wheat or other corn, appear the next season as a weed; but by ploughing it in as soon as poſsible, it will vegetate quickly, and after the manure has been set on and spread, the ploughing in will destroy the shelled Buck Wheat, and bring the land into a perfectly clean condition for receiving the seed for the next crop.

When the Buck Wheat has been mowed for *Green Fodder*, a single ploughing will be sufficient for making the land in good order for the reception of the seed intended to be sown.

ESSAY VI.

Experiments and concise Agricultural Observations.

In the different Agricultural Surveys made under the direction of the Board of Agriculture, as well as in other works of distinguished merit, there are recorded a number of experiments and concise observations, which, from their brevity, cannot be reduced into the form of Eſsays. Induced by that consideration, I propose to insert in each of these Volumes a limited number of short pieces, under the general head of "Experiments and concise Observations;" and I flatter myself that this mode will meet with the approbation of the public, who may not be disposed to receive instruction from elaborate diſsertations.

1. *On the Ripening and Filling of the Ears of Corn**.

The summer of 1782, having been remarkably cold and unfavourable, the harvest was very late, and much of the grain, especially oats, was green even in October. In the beginning of October, the cold was so great, that, in one night, there was produced on ponds near Kinneil, in the neighbourhood of Borrowstownneſs, ice three quarters of an inch thick. It was apprehended by many farmers, that such a degree of cold would effectually prevent the further filling and ripening of their corn. In order to ascertain this point, I selected several stalks of oats, of nearly equal fulneſs, and immediately cut those which, on the most attentive comparison, appeared the best, and marked the others, but allowed to remain in the field fourteen days longer; at the end of which time, they too were cut, and kept in a dry room for ten days. The grains of each parcel were then weighed; when eleven of the grains which were left standing in the field, were found to be equal in weight to thirty of the grains which were cut a fortnight sooner, though even the best of the grains were far from being ripe. During that fortnight (viz. from October 7, to October 21) the average heat, according to FAHRENHEIT's Thermometer, which was observed every day at eight o'clock in the morning and six in the evening, was a little above 43. This ripening and filling of corn, in so low a temperature, should be the leſs surprising to us, when we reflect, that seed-corn will vegetate in the same degree of heat; from which may be drawn this important inference, viz. that farmers should be cautious of cutting down their unripe corn, on the supposition, that, in a cold Autumn, it will fill no more.

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* By John Roebuck, M. D.

2, *On the Purification of Sea Salt*[*].

The Earl of DUNDONALD observes, that the common sea-salt poſseſses a considerable mixture of ingredients, which render it in a great degree, unfit for preserving victuals. These ingredients appear, by experiment, to be nauseous, bitter, and cathartic salts, having an earthy basis, (magnesia salita, and magnesia vitriolata, or Epsom salt) which are intimately mixed with the proper sea-salt.

To purify common sea-salt, by diſsolving it in water, decompounding the bitter salts, and precipitating their earthy basis, by adding a fixed alkali, whether foſsil or vegetable, is a tedious proceſs, and by far too expensive to be employed for economical or mercantile purposes. It is even imperfect; as it is almost impoſsible, after that proceſs, to separate from the sea-salt the Glauber salt, or vitriolated tartar, or salt of Sylvius, which are produced according as the foſsil or vegetable alkali is used.

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[*] Communicated by A. Hunter, M. D.

The Earl of DUNDONALD observes, That hot water, saturated with sea-salt, will still diſsolve a great part of the bitter earthy salts. His method, therefore, of purifying the common sea-salt from those bitter salts is, to take a conical veſsel, having a hole in the small end of it, which is to be undermost, to place it, filled with common salt, in a moderate heat; to take onetwentieth part of the salt contained in it, and putting it in an iron pan, to diſsolve it in its proper proportion of water, so that the water shall be completely saturated with the salt; and then to pour this solution boiling hot on the salt in the conical veſsel, which is to be purified. The boiling water being already saturated with sea-salt, will diſsolve no more of it, but will diſsolve much of the bitter earthy salts; and this solution will gradually drop out at the hole in the bottom of the cone. When it ceases to drop, the same proceſs is to be repeated by means of fresh portions of the same parcel of salt, already partly purified, till it be brought to the required degree of purity. Lord DUNDONALD reckons, that three such washings make the common salt of this country purer than any foreign salt; that each washing makes it 4½ times purer than before; so that (disregarding fractions) after the second washing it will be 20 times, after the third 91 times, after the fourth 410 times, and after the fifth 1845 times purer than at first.

The superiority of salt, thus purified, to common salt, is discovered by the taste, as well as by its effect in preserving fish, flesh, and butter; for it hath been often and carefully tried. Lord DUNDONALD conceives, that the simplicity, facility, and cheapneſs of this method of purifying salt, should recommend it to common practice, as it is an object of great public importance, especially to farmers who consume much salt in salting butter and bacon.

As all salt made by boiling has a portion of uncombined magnesia mixed with it, his Lordship is of opinion, that a little muriatic acid should be added to the first brine poured on the salt, in order to diſsolve the magnesia, and carry it off. The following table will show what the common salt loses before it can be brought to a state of perfect purity.

TABLE.

Salt employed.	lb.	oz.		Purified Salt. lb.	oz.		Magnesia salita Magn. vitriol. lb.	oz.			
Salt hot from the pan first drawn,	56	0	contained of	49	0	and of	6	5	which is equal nearly to	1/9	of salt employed.
Salt hot from the pan last drawn,	56	0		33	9		22	6		2/5	Ditto
Medium of the above,	56	0		41	4		14	5		1/4	Ditto
Salt 6 weeks old,	56	0		47	0		7	0		1/8	Ditto
Salt first drawn, dripped 24 hours,	56	0		52	12		3	0		1/18	Ditto
Salt last drawn, dripped 24 hours,	56	0		44	8		11	0		1/5	Ditto
Medium of the two last,	56	0		48	10		7	0		1/8	Ditto
Spanish great Salt,	10	0		9	15½		0	0¼		1/640	Ditto
Basket fine Salt,	3	0		3	0		0	0			

3. *On a Preparation of Carrots for the Use of Seamen in long Voyages*[*].

The great utility of all kinds of vegetables in curing and preventing that species of the scurvy to which seamen are particularly liable, is so clearly ascertained, that it will be unnecеſsary to employ any time in the proof of it; I shall therefore proceed to describe a remedy of the vegetable kingdom that probably may answer the happy purposes of preventing, mitigating, or curing the sea scurvy, and all such diseases as derive their origin from the want of vegetable food.

The vegetable I mean to recommend is Carrots, and as it is impoſsible to preserve them in their natural state for any length of time, we must be content with an artificial preparation. The following is the method I have ſucceſsfully made use of.

Take any quantity of Carrots in the months of September or October. Let them be topped and tailed, and afterwards washed clean in warm water. Scrape them, and cut them into pieces about two inches in length, throwing away such parts as are decayed. Put the whole into a large copper, with as much water as will preserve the bottom from burning. Cover them up close, and light a moderate fire underneath, so that the Carrots may be stewed and softened in the steam. When they have become sufficiently soft, let them be mashed and pulped through a coarse sieve. Then take a quantity of loaf sugar equal to the weight of the pulp, and, according to the rules of confectionary, reduce the whole over the fire to a proper consistence, taking care to evaporate the superfluous moisture by continual stirring. When cold, put this marmalade into pots, covering it over with a paper moistened in brandy; and over that such another covering as is generally recommended for conserves.

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[*] By A. Hunter, M. D.

This I consider as the neatest preparation of Carrots, and may be recommended for tarts, dumplins, &c. for the officers' tables. Another preparation for the seamen may be made with coarser sugar; and the Carrots, instead of being pulped through a sieve, may be mashed by the circular stone employed in the cyder mills, and afterwards boiled up to a proper consistence. And as this last preparation will be consumed in large quantities, it may be put up into small casks.—The quantity intended for one day's consumption, should be taken out and mixed in an earthern or wooden veſsel, with as much of the strong spirit of vitriol as will give it a grateful degree of acidity; after which it may be used in a variety of forms. A spoonful of this marmalade, put to a proper quantity of water, makes a cool and wholesome drink in fevers, and all disorders proceeding from putrescency; and probably when given in this manner, with a little brandy, it may become a general preservative against the scurvy. Seamen may also have it in the form of dumplins, in which shape a full meal of vegetable food may be afforded at a small expense. I once sent a cask of this marmalade into the Mediterranean, and had the pleasure of hearing that it answered a very valuable purpose.

In order to be satisfied that this cheap and palatable antiscorbutic will keep in a warm climate, I preserved some pots of it, for twelve months, in a room heated with a constant fire, and had the pleasure to observe that it kept extremely well. I ordered some of the pots to be acidulated, but the conserve did not keep so well; so that it is the better way to use the acid occasionally, as formerly directed.

A palatable meſs may be made as follows: Take Carrot-marmalade, one large spoonful; salop, in powder, one tea-spoonful. Acidulate with lemon-juice or spirit of vitriol; then add warm water, half a pint; wine, four spoonfuls; spices, a small portion, if required. This mixture is highly antiputrescent and nutritive.

The health of the British seamen is so eſsential to the welfare and interest of these kingdoms, that I flatter myself every attempt that has this great object in view, will meet with a favourable reception.

4. *On Bones used as a Manure**.

During a long course of speculative and practical Agriculture, in which, with critical exactneſs, I employed myself in making experiments upon almost every kind of manure, I was fortunate enough to discover that bones are superior to all the manures made use of by the farmer.

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* By Anthony St. Leger, Esq. 1777.

Eight years ago, I laid down to graſs a large piece of very indifferent limestone land with a crop of corn; and, in order that the graſs-seeds might have a strong vegetation, I took care to see it well dreſsed. From this piece I selected three roods of equal quality with the rest, and dreſsed them with bones broken very small, at the rate of sixty bushels per acre. Upon the lands thus managed, the crop of corn was infinitely superior to the rest. The next year the graſs was also superior, and has continued to preserve the same superiority ever since, insomuch that in spring it is green three weeks before the rest of the field.

This year I propose to plough up the field, as the *Festuca Sylvatica (Prye Graſs)* has overpowered the graſs seeds originally sown. And here it will be proper to remark, that, notwithstanding this species of graſs is the natural produce of the soil, the three roods on which the bones were laid have hardly any of it, but on the contrary have all along produced the finest graſses.

Last year, I dreſsed two acres with bones in

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October (1774) and rolled them in.
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ne. However, I have found from re-
ed experience that, upon graſs ground,
is kind of manure exerts itself more power-
fully the second year than the first.

It must be obvious to every person, that the bones should be well broken before they can be equally spread upon the land. No pieces should exceed the size of marbles. To perform this neceſsary operation, I would recommend the bones to be sufficiently bruised by putting them under a circular stone, which being moved round upon its edge by means of a horse, in the manner that tanners grind their bark, will very expeditiously effect the purpose. At Sheffield it is now become a trade to grind bones for the use of the farmer. Some people break them small with hammers upon a piece of iron, but that method is inferior to grinding. To ascertain the comparative merit of ground and unground bones, I last year dreſsed two acres of turnips with large bones, in the same field where the ground ones were used; the result of this experiment was, that the unground materials did not perform the least service; while those parts of the field, on which the ground bones were laid, were greatly benefitted.

I find that bones of all kinds will answer the purposes of a rich dreſsing, but those of fat cattle I apprehend are the best. The London bones, as I am informed, undergo the action of boiling water, for which reason they must be much inferior to such as retain their oily parts; and this is another of the many proofs that oil is the *food* of plants. The farmers in this neighbourhood are become so fond of this kind of manure, that the price is now advanced to one shilling and fourpence per bushel, and even at that price they send sixteen miles for it.

I have found it a judicious practice to mix ashes with the bones; and this winter (1777)

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rehend that oily substances cannot pro- any considerable effect upon land, unleſs they be previously combined with mucilages, or be converted into soap by means of quicklime, or fixed alkalies. In this state they meliorate the soil in several ways, viz. by affording a lasting pabulum for plants; by fitting it to receive, and preventing the too speedy evaporation of the dews and rain; and by presenting the food of vegetables in a due proportion to the absorbent veſsels of their roots.

Saline substances, as they are soluble in water, and capable of admiſsion into the vascular tubes of plants, act more immediately on the earth. Whether they afford any real nutriment to vegetables, or whether their operation depends upon a stimulating power, by which they quicken vegetation, I am at a loſs to determine; for that plants are endued with irritability is evident from various facts. The sensitive tribe of vegetables afford us ocular demonstration of it; and electricity is well known to accelerate the growth of plants by promoting the aſcent of their juices.

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* By T. Percival, M. D.

Common salt is universally esteemed an excellent manure; but I think it would be still more powerful if a proper quantity of Epsom salt were added to it. By this combination it would more exactly resemble sea-water, which amazingly fertilizes the marshes over which it flows. The graſs of such marshes is purgative to horses and to cattle, which affords a presumptive proof that sea-salt, mixed with the bittern, may be received into the veſsels of plants in a much larger proportion than when purified and refined. The combination here recommended, will act as a powerful septic, when mixed with the corrupted vegetables and other putrefying substances on the surface of the earth; and by this fermentation will improve the soil.

Quick-lime is not claſsed by the modern

chemists amongst the salts, though it has some properties in common with them. It may act as a manure by combining with and dividing the particles of clay, and thus forming a species of marl; by uniting with the oily substances contained in the soil, and rendering them soluble in water; and by absorbing the dews and rains, and preventing them from sinking too speedily into the earth, by which the food of plants is washed from their radical fibres.

Lime and the fixed alkalis are more powerful agents than neutral salts in preparing the food of vegetables, by their operation on the oils and mucilages which exist in the soil, and which have been supplied by manures, or derived from the atmosphere.

6. *On Potatoes*[*],

In the spring, 1782, an old lay was ploughed up. The first plough skimmed off the turf about an inch and a half deep; women followed, and laid the potatoe sets (the globe white, called also the Champion) in that furrow; then came another plough that cut as deep as poſsible, covering the sets nine inches deep. There is no danger of burying the sets, as they rise freely. In this manner, without any manure, I planted every third or fourth furrow; part one, and part the other. In the first, the rows were twenty-seven inches asunder; in the last, three feet. The former yielded the greater crop. They were all kept clean by horse and hand-hoeing: The crop was taken up with three-pronged forks at the expense of a halfpenny a bushel. The produce, 400 bushels an acre; and sold at two shillings a bushel, or 40l. an acre; a large sum gained at a small expense.

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[*] By John Kirby, Esq.

7. *To make Potatoe Yeast*[*].

Boil Potatoes, of the mealy sort, till they are thoroughly enough; skin and mash them very smooth, and put to the maſs as much hot water as will make it of the consistency of common yeast; after which run it through a cullendar. Add to every pound of mashed potatoes, two ounces of brown sugar; and when just warm, stir in, for every pound of potatoes, two spoonfuls of common yeast. Keep the mixture warm till it has done fermenting, and in twenty-four hours it may be

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[*] By A. Hunter, M. D.

toes will make a quart
keep a month or six
bread eight or ten hours
it. Bread made with
t, is not to be distinguished from
with yeast purchased of the brewer.

*On the Round Winter Red Potatoe, and the Long Winter ditto with many eyes**.

Those two kinds of Potatoes, though differing in appearance, seem to poſseſs nearly the same qualities; they resemble each other in taste and flavour, and ripen at the same time. Both of them grow well upon strong clay and heavy loams, and both seem to be in the highest perfection in the spring. This last is no inconsiderable advantage, as they can with little trouble be kept fresh and palatable till after midsummer; but the circumstance of their delighting in a clay soil, renders them highly valuable in situations where the soil is mostly of that kind, and where the other sorts, if planted, would be of a watery inferior quality, and would also be very unproductive.

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* By Mr. Somerville.

9. *On Potatoes, as a Food for Dogs*[*].

To render Potatoes useful in this way, they should first be thoroughly boiled, and afterwards hashed down amongst boiling water, taking care to incorporate them with the water till they attain the consistence of thin starch. At first it will be neceſsary to add a small quantity of coarse fat, or salt butter, to induce the dogs to eat this new food, but after awhile it may be removed by degrees. With this feeding, with the addition of ox livers, and occasionally of horse flesh, boiled along with the potatoes, dogs may be kept both in good flesh and wind, at one-fourth of the expense which trained dogs generally cost, especially at a time when oatmeal is dear.

10. *On Potatoes, as a Food for Fowls*[†].

Boiled Potatoes are found to be an excellent food for fowls of almost every description, with a small mixture of bran or oatmeal. By adopting the use of them for this purpose, a considerable quantity of grain may be saved,

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[*] By Mr. Somerville.

[†] By Mr. Somerville.

tenance of the present
ne number may be kept,
the market, at leſs expense
small stock can be reared.

y be disposed to think the benefit
m this substitute for the feeding of
matter of little importance; and in
situations this may really be the case;
when it is taken upon a broad scale, and
e quantity of grain that is consumed over the whole kingdom, for this purpose alone, is considered, the aggregate will be found to be great indeed. But when to this advantage is added the benefit arising from feeding double, or even more than double, the number at leſs expense, it then will appear a matter of serious consideration.

11. *On Ground Cisterns*[*].

In high situations in the eastern part of the North-Riding of Yorkshire, neceſsity has induced the inhabitants to make reservoirs, or water-cisterns, within the ground: these are fed by rain water, which falls upon the roofs of the buildings, and is conducted from thence by spouts. In these cisterns, a very ample supply of soft water is always at hand; and, by their being under ground, and kept close, the water is sweet, and suitable to every domestic purpose.

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[*] By Mr. John Tuke.

A cube of the required size being dug in the ground, and the sides made even and perpendicular, the bottom is covered with so much clay, as that, when well beaten, will be four inches thick; a foundation of stone to build the wall upon, is then laid round the sides; upon the clay a brick floor is laid in terras, the surface of which should not be lower than the top of the stone foundation; the sides are then built a single brick thick, and the bricks laid in terras, a foot space being left betwixt the wall and the earth, which is gradually filled with clay in a soft state; and this is well beaten as it stiffens; the whole is arched over, leaving a hatchway for a man to go in to clean it, and an opening into a drain, for the surplus water to run off, when the cistern is full.

The water is raised by a pump.

As keeping all external air out of the cistern, to the sweetneſs of the which the cistern is fed, tinued to within a few inches of n; and the surplus water should be off by a pipe rising from near the m to the extreme height the water is wished ever to be at, and there communicate with the drain: by these precautions, there will not be more of the surface of the water exposed to the external air, than what is with in those pipes and that of the pump. As trifling showers carry soot and dust into the reservoir, it would be an improvement, if, by a cock, they were prevented finding their way into the cistern. For the same reason, the early part of lasting showers should be kept out.

12. *On Paring and Burning*[*].

In regard to paring and burning, I am of opinion, that nothing contributes more to the improvement of an estate of a maiden soil, provided the tenant is not permitted to make too free in cropping it, for his immediate benefit, beyond its natural course.

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[*] By E. Cleaver, Esq.

I have pared and burnt, upon my different farms, near 1000 acres; and am perſuaded that there are not many farms that ſurpaſs mine in the weight of the corn crops, after this proceſs, which I have practised near thirty years, though I never ventured to pare the same land a second time, as very little ashes would be produced. I find no inconvenience in paring and burning thin soils, because, after one, and sometimes two, turnip crops, the soil swells so, by being enriched, that it appears deeper than when first broken up. I allude to a piece of ground in my farm at Nunnington, called Calkleſs, which answers beyond all belief. On this bad land I have reaped four quarters per acre of wheat, and in one instance forty-one bushels. I recommend the sods to be as lightly burnt as poſsible, and not consumed to red ashes. It is best to spread the ashes as soon as burnt, otherwise the turnips, or corn, will grow in patches; besides, if a high wind should come, it may blow all the ashes away which are in the heaps, although it would not affect those spread upon the ground. This happened to me some years ago, upon a farm I have upon the Wolds; in a few hours, the ashes which were in hills unspread, were blown off the premises, while those which were spread a few days before, remained unmolested.

13. *On Teasles**.

Teasles will only answer upon a strong soil; if the land be fresh, they do not require much manure. They are frequently sown upon pared and burnt land, as well as upon land ploughed out of swarth, and also after a winter and spring fallow.

SEED, AND TIME OF SOWING.

Sow from one to two pecks of seed per acre, a little before May-day.

CULTURE WHILST GROWING.

The surface of the ground, to the depth of about one inch and a half, is turned over with spades three times, viz. in June, October, and about Lady-day, at an expense of about 20s. per acre, each time. The plants are set out about a foot distance, in the first operation.

HARVESTING, AND PREPARING FOR MARKET.

Teasles are fit to reap in the latter end of August, or beginning of September. This is done by cutting them off with about nine inches of stalk, and at the expense of six shillings per thousand bunches. They are then tied up for 5s. per thousand, each bunch containing ten teasles.

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* By Mr. John Tuke.

PRODUCE.

Ten packs per acre is a good crop; each pack containing 1350 bunches.

PRICE.

From three to five guines per pack.

14. *On Sainfoin*[*].

This is a species of graſs that may be raised to great advantage on a chalky soil. The small expense attending its cultivation, its natural relation to a chalk soil, the constant demand for its hay at market, and the small charges acquired in making it, all combine to enforce its cultivation on the most barren chalks; which by any other course of husbandry could hardly have been brought to pay the expense of tillage. By attending to this species of graſs, the farmer will have it in his power to bestow a greater attention on the more fertile parts of his land; he will require fewer horses and servants; and will, in general, ensure to himself plentiful crops of grain from that part of the farm which is kept in constant tillage; whilst the most barren part will produce a yearly increase from the Sainfoin, at a trifling expense in the culture. Thus stocked with plenty of hay, the farmer cannot fail of profeſsional succeſs.

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[*] By John Bannister, Esq.

15. *On the Use of Clay as a Manure*[*].

On light sandy soils, clay may be advantageously used as a manure; but as this undertaking will be attended with a very heavy expense, it should never be embarked in where there is not a great probability of succeſs, and this probability may easily be confirmed by an experiment upon a small scale. If the clay is to be fetched from a considerable distance, and the land to be dreſsed with it be very steril in its nature, these will be sufficient discouragements to the farmer not to hazard an extensive trial; but if, from experience, he be convinced that his crops, though poor, do only languish from a want of stability in the land,

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[*] By John Bannister, Esq.

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which, by a proper dreſsing of clay, would
so far improved, as to approach nearly to
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reasonably incline the renter of such a s
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claying land is the summer; and it is
method to mix it with mould, or
manure, to encourage it to fall kindl
quantity of clay should not be leſs tha
loads per acre, which, if to be b
a considerable distance, will effectu
improvement.

16. *On the advantages of raising Pota*
for the use of the Cottager

In the parish where I resid
which, except five acres, is my
are thirty cottages, contair
people. I have, for five or
allotted, free from rent, four
tended to be sown with wl
autumn, for the cottager
Potatoes; by which mean
ten to fifteen sacks, equal
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* By Sir John Met

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grow. In October, they dig them up; and it is the most pleasant thing imaginable, to see the men, their wives and children, gathering the produce of their little farms, which is to serve them the ensuing winter. Was this plan generally adopted, the labourers would consume but little corn; which would supply the manufacturing towns, and we should have no occasion to import. As four acres are sufficient for thirty families, it would take but a small quantity of land from every farm in in the kingdom The way practised here, is to plant the Potatoes in furrows, eighteen inches apart, and a foot apart in the rows. The land about me is of different qualities; on the hills, rather light; in the vale, near the parish, inclining to clay; but all fit for Turnips: the Potatoes are planted in the low land, being nearer home. The poor, at present, will not live entirely without bread, as many do in Ireland, though Potatoes daily get into use more and more; and I am persuaded, was my plan generally adopted, in two or three years the labourers in the country would consume but little or no corn. Thirty years ago, the poor in this part of the country would not eat Potatoes, if they could get other roots or vegetables.

17. *The Course to be observed after Marling*[*].

Take one crop of oats the spring subsequent to the marling: plough the stubble immediately, in order to expose the marl again to the influence of the frost: fallow with manure for turnips; a crop, under this management, is never known to fail: then barley, clover, wheat, turnips fed off with sheep, and barley again, with well-dreſsed hay-seeds, and white clover and trefoil, for a perennial lay, or at least for some years. Land thus husbanded produces in a most exuberant degree, and at the same time is rendered perfectly clean from all weeds, without being haraſsed in the least. Poor sandy lands are thus rendered capable of producing a covering of the richest graſses, and under proper management may be depended on in all seasons.

18. *On Vetches*[†].

The vetch is a most excellent vegetable, and great advantages may be derived from it in various ways. If a piece of barley, or wheat stubble, which comes in course for turnips, be found tolerably clean and mellow after harvest, it is a good practice to sow winter vetches upon it, and harrow them in as soon as the corn is off. They will often produce a great deal of valuable food for ewes and lambs in the spring, when such kind of aſsistance is of inestimable value, and yet admit of the land being got into very good order for turnips. Vetches are likewise of the greatest profit when cut green, in the course of the summer, and given to cows and working horses in the stable. An acre, cut and used in this way, will go farther, and do the horses more good, than two acres eaten off in the field: working horses want rest; in the stable they are not teased by flies; besides, the quantity of manure which horses make, so foddered, is prodigious.

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[*] By Mr. John Holt.

[†] By N. Kent, Esq.

19. *On the saving of Hay*[*].

The farmer cannot be too attentive to the saving of hay. It is not uncommon to see a fourth or a fifth part of it wasted in the consumption, by being given to cattle in too great quantities at a time, and in a loose

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[*] By N. Kent, Esq.

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3s. 6d. a day.

20. *On Early Potatoes*[*].

In Lancashire, where the cultivation of the rly Potatoe is well understood, they cut the sets, and put them on a room floor, where a strong current of air can be introduced at pleasure. The sets are laid thin, about two lays in depth, and covered with oat shells, or saw-dust, about two inches thick: this skreens them from the winter frosts, and keaps them moderately warm, causing them to vegetate, but at the same time admits air to strengthen them, and harden their shoots, which the cultivators improve by opening the doors and windows on every opportunity afforded by mild soft weather: They frequently examine them, and when the shoots are sprung an inch and a half, or two inches, they carefully remove one half of their covering, with a wooden rake, or with their hands, taking care not to disturb, or break the shoots. Light is requisite as well as air, to strengthen and establish the shoots; on which account a green-house has the advantage of a room, but a room answers very well, with a good window or two in it, and if to the sun still better: in this manner they suffer the sets to remain till the planting season, giving all the air poſsible by the doors and windows, when it can be done with safety from frost: by this method the shoots at the top become green, and leaves are sprung, which are moderately hardy. They then plant them in rows, in the usual method, by a setting stick, and carefully rake up the cavities made by the stick. By following this method, the sets are made to bear a little frost without injury. The superin

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[*] By Mr. J. Blundell.

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ERIMENT I.

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into the scales, weighed 2 ounces

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* By Mr. John Holt.

11 drams. October the 18th, being put into the scales again, then weighed 2 ounces 7 drams. The loſs of weight per bushel of 70 pounds, (the customary measure of this neighbourhood) is 6 pounds, 8 ounces, and 3 drams, nearly, or almost one-tenth of the whole in 49 days. But this is the greatest loſs that grain can poſsibly sustain, which, although perfectly ripe, had neither the advantage of being dried in the sun after being reaped, nor had it undergone the proceſs of fermentation after being got together.— N. B. Thirty-two grains weighed one pennyweight.

BARLEY.

EXP. II. *Sept.* 2. Under the same circumstances put into the scales 2 ounces and 2 drams of barley, which, being tried again Oct. the 18th, weighed 1 ounce and 12 drams, or, at 60 pounds to the bushel, had lost 8 pounds, 4 ounces, and 22 drams, or about one-seventh of the whole in forty-seven days.

N. B. Twenty-four grains of this barley weighed one pennyweight two grains, so that this corn must have been softer, or in a leſs matured state, than the grains of wheat in the first experiment. Since 24 grains of plump wheat are reckoned to weigh one pennyweight, and hence the standard of that weight; whereas we see the pennyweight took 32 grains.

WHEAT.

EXP. III. *Oct.* 22. Put into the scales six ounces three drams, which in twenty-four days lost three drams, or after the rate of two pounds, one ounce, fifteen drams per bushel.

WHEAT.

EXP. IV. *Jan.* 8, 1790. Took two ounces two drams of wheat, which in thirty-two days lost after the rate of two pounds fifteen drams per bushel.

From these experiments it appears that the decrease in weight was pretty regular from the time of harvest, and the time taken in ascertaining the loſs of each quantity: in other words, that the sum of the matter evaporated becomes gradually leſs according to the length of time kept on hand, but proves that the sooner the crop is brought to market, *cæteris paribus*, the greater is the advantage to the farmer.

parish, if the man has a good character, frequently subscribe to set him up, from charitable motives, and from a persuasion that by this means his family will never want relief from the parish: and this is so much the case, that when a labourer dies, and his son takes his land and stock, he in some cases maintains the widow. I know of several instances of labourers' widows, now past work, who are maintained by their sons, but could not otherwise have lived without parish relief.

When a poor man's cow dies, it is certainly a great diſtreſs; and, sometimes, the owner is obliged to ask aſsistance, to replace her. Somehow, or other, they always contrive to get one; as I scarcely ever knew a cow-gate given up for want of ability to obtain a cow, except in the case of old and infirm women, who are left without children: for they cannot, without some aſsistance, live upon the profits of a cow, nor can they manage it properly. Should a case of this sort occur, the parish officers would act very unwisely in refusing aſsistance, as a very trifling allowance, together with the cow, would enable a woman to live; whereas, by refusing any aſsistance, they oblige the woman to part with her cow, and then the culinary proceſs. A potatoe that weighed 2 ounces, 7 dwts. and 5 grains, in its natural state, after being roasted only weighed 1 ounce, 5 dwts.; another before being put into water weighed 2 ounces, 5 dwts. and 6 grains, but immediately after being boiled, had lost 54 grains.

ESSAY VII.

On Cottagers.

As much of the farmer's buſineſs is conducted by day labourers, usually denominated "Cottagers", it seems to be indispensibly neceſsary that their employers should place them in situations that will give encouragement to personal exertion. It is not sufficient that they be paid for their daily labour; something more should be done, and that something, I conceive, should be what will gradually teach them and their families how to employ a few hours for their own advantage, after the labour of the day. The Earl of Winchilsea, Lord Carrington, Sir John Methuen Poore, and John Way, Esq. have set the kingdom at large some noble examples of what may be done in this way, of which, the following are impreſsive instances of benevolence.

1. *An illustrious example of attention to the condition of the Cottager*[*].

Upon my estate in the county of Rutland, there are from seventy to eighty labourers, who keep from one to four cows each. I have always heard that they are hard-working industrious men. They manage their land well, and pay their rent very regularly. From what I have seen of them I am more and more confirmed in the opinion I have long held, that nothing is so beneficial both to them and to the land owners, as their having land to be occupied either for the keeping of cows, or as gardens, according to circumstances.

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[*] By the Earl of Winchilsea.

By means of these advantages the labourers and their families live better, and are consequently more fit to endure labour; they are more contented, and more attached to their situation, and acquire a sort of independence, which makes them set a higher value upon their character. In the neighbourhood in which I live, men so circumstanced are almost always considered as the most to be depended upon and trusted. The poſseſsing of a little property certainly gives a spur to industry; as a proof of this, it has almost always happened to me, that when a labourer has obtained a cow, and land sufficient to maintain her, the first thing he has thought of has been, how he is pasture for the cows in summer, and the other is kept as meadow land to provide hay for them in winter. Each cottager knows his own piece of meadow land, and he lays upon it all the manure which he can obtain, in order that he may have the more hay. When one of the two plats of ground has been mown for two or three years, it is then converted into the summer pasture, and the other is used as meadow land; by which means no part of the land, occupied by the cottagers, is injured by constant mowing.

The cottagers are independent of the greater farmers; holding their cottages and lands directly of Lord Carrington, and not as under-tenants. This gives them a degree of respectability, which they would not otherwise poſseſs. The rent, which they pay for their land, is below the farmer's rent; but it is certain that, in the greatest part of this kingdom, the cottager would rejoice at being permitted to pay the utmost value given by the farmers, for as much land as would keep a cow, if he could obtain it at that price.

Lord Carrington is the patron of the living of Humberston; and, upon the last vacancy he gave it to a respectable and conscientious clergyman, who has exerted himself very strenuously in the religious and moral improvement of his parishioners. He has laboured with great and good effect. The cottagers are sober and industrious: and it is not known that any man of the parish lives in a course of habitual immorality. The clergyman, with Lord Carrington's aſsistance, has also succeeded in establishing, for the benefit of the youth at Humberston, a parish-school; which has been of very eſsential service to the parish.

There is no public-house at Humberston; nor do the parishioners desire one: and on this account there are no cockfightings or gaming, within the parish; nor any drunken meetings for the purpose of settling the parish-rates. The poor-rates in the parish of Humberston, which include the charges for the families of the militia, never amount to more than ninepence or tenpence in the pound on the rental, and generally are under sixpence.

The reduction of the poor-rates, the increase of the comforts, and the improvement of the religious and moral habits of the poor, in the parish of Humberston, may be fairly ascribed to the circumstances above stated. The publication of the letter of the Earl of Winchilsea, on the expediency and benefit of letting small quantities of land to cottagers, to enable them to keep cows, will, I trust, be of the greatest use to the country. Exclusive of the benevolence and charity of thus adding to the comforts of the poor, advantages of the utmost importance must be derived from such a system, by the land-owners and farmers themselves. It is eſsential to every farmer, that there should be a sufficient number of labourers in his neighbourhood, to enable him to occupy his land to the greatest advantage; otherwise he cannot afford to pay a fair and full rent for his land, and manage his farm in a manner beneficial to himself and to his landlord. Those labourers, who have no local advantage of situation, no tye of property, nor any appropriate benefit to attach them to a peculiar spot, are inclined to wander up and down a country, without any fixed connexion; and are always ready to change their employer for a trifling advance in their wages: whereas those cottagers, who have the advantages of property, who poſseſs a cow, and rent a little ground, are the persons on whose aſsistance the farmer may depend in the time of neceſsity, and on whose honesty and ability he may implicitly rely.

I have no hesitation, however, in affirming, that where cottagers occupy arable land, it is very rarely of advantage to them, and generally a prejudice to the estate. The expense of keeping a team, swallows up all the profit of a small quantity of arable land; and if the cottager depends on hiring horses and farming utensils, in order to work his land, the expense of them, and the occasional loſs from the uncertainty of obtaining them when they are most wanted, will be more than the profits of his land will bear.

The cottager, who rents arable land, will seldom labour for other people; but will waste a great deal of his time to little benefit to himself. Much of his labour will be unproductive, because misapplied. From want of knowledge as a farmer, or from the preſs of neceſsity, he will croſs-crop his ground; or, in other words, repeat his crops, till it becomes exhausted and foul, and incapable of any produce at all; and then he will complain that the land is bad and dear, and will find himself in a situation inferior to that of the labourer who has not the advantage of any land at all.

The late Abel Smith, Esq. from motives of kindneſs to several cottagers on one of his estates in Nottinghamshire, let to each of them a small piece of arable land. I have rode over that estate with Lord Carrington several times since it descended to him; and I have invariably observed, that the tenants upon it, who occupy only eight or ten acres of arable land, are poor, and their land in bad condition. They would thrive more, and enjoy greater comfort, with the means of keeping two or three cows each, than with three times their present quantity of arable land; but it would be a greater mortification to them to be deprived of it, than their landlord is disposed to inflict. If you give a cottager a garden, and graſs-land on which to keep two cows, and he has ability and prudence to manage them, he will have comfort, and a considerable degree of affluence: but if you add a few acres of arable land, and make a little farmer of him, he will always be in poverty and distreſs.

3. *An account of a Cottager's Family**.

In the year 1779, a tenant of mine, at Hasketon, in the county of Suffolk, died, leaving a widow, and fourteen children, the eldest of which was a girl, under 14 years of age. He had held under me 14 acres of pasture land, in four inclosures, at a moderate rent of 13l. a year; and had kept two cows, which, with a very little furniture and clothing, was all the property that devolved, upon his death, to his widow and children.

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* By John Way, Esq.

The parish of Hasketon is within the district of one of the incorporated houses of industry; one of the first that was erected in the kingdom. The rule of the house is to receive all proper objects within the walls, but not to allow any thing for the relief of the out poor, except in cases which have a peculiar claim. The directors of the house of industry, upon being made acquainted with the situation of the family, immediately agreed to relieve the widow, by taking her seven youngest children into the house. This was proposed to her; but, with great agitation of mind, she refused to part with any of her children. She said, she would rather die in working to maintain them, or go herself with all of them into the house and there work for them, than either part with them all, or suffer any partiality to be shown to any of them. She then declared that if I, her landlord, would continue her in the farm, as she called it, she would undertake to maintain and bring up all her 14 children, without any parochial aſsistance.

She persisted in her resolution; and being a strong woman about 45 years old, I told her she should continue the tenant, and hold it the first year rent-free. This she accepted with much thankfulneſs; and aſsured me, that she would manage for her family without any other aſsistance. At the same time, though without her knowledge, I directed my receiver not to call upon her at all for her rent; conceiving that it would be a great thing, if she could support so large a family, even with that indulgence.

The result, however, was, that with the benefit of her two cows, and of the land, she exerted herself so as to bring up all her children; 12 of whom she placed out in service, continuing to pay her rent regularly of her own accord to my receiver every year after the first.—She carried part of the milk of her two cows, together with the cream and butter, every day to sell at Woodbridge, a market town two miles off, and brought back bread and other neceſsaries; with which, and with her skim-milk, butter-milk, &c. she supported her family. The eldest girls took care of the rest while the mother was gone to Woodbridge; and by degrees, as they grew up, the children went into the service of the neighbouring farmers.

The widow at length came and informed me, that all her children, except the two youngest, were able to get their own living; and that she had taken up the employment of a nurse; which was a leſs laborious situation, and at the same time would enable her to provide for the two remaining children, who indeed could now almost maintain themselves. She therefore gave up the land, expreſsing great gratitude for the enjoyment of it, which had afforded her the means of supporting her family, under a calamity, which must otherwise have driven both her and her children into a workhouse.

This is an extraordinary instance of what maternal affection, aſsisted by a little kindneſs and encouragement, will do. To separate the children of the poor from their parents, is equally impolitic and unkind. It destroys the energy of the parent, and the affections and principles of the child. Man is a creature of wants. From them are derived all our exertions. On the neceſsity of the infant is founded the affection of the mother; and among the poor, (I except those cases where parental affection may be chilled and enfeebled by extreme depreſsion of circumstances)—where that neceſsity exists in the greatest force, natural affection is generally the strongest.

The supplying of cottagers with small gardens, and in some instances with the means of keeping a cow, will tend to diminish the calls for parochial relief; and to render unneceſsary that barbarous system, of removing the child from its natural and most affectionate guardians. The year's rent remitted, and the land confided to this poor widow, not only enabled her to support and educate her children at home, but was the means of saving the parish a very considerable expense; as the reception and feeding and clothing of the seven youngest children, at an expense of hardly leſs than seventy pounds a year, would probably have been followed by nearly an equal expense with the widow and the other children. Besides this, the encouragement of industry and good management among the poor in their cottages, and aſsisting them in their endeavours to thrive, will contribute to the increase of a hardy and industrious race of people; and will afford a supply to our markets of eggs, butter, poultry, pigs, garden stuff, and many other articles of life; tending to lower the price of provisions, to prevent monopoly, to enrich the country, and to make it powerful both in people and produce, to a degree beyond all calculation.

4. *A meritorious example of Parochial attention to the condition of the Cottager*[*].

It was deemed neceſsary during the high price of corn, that some general system should be adopted for the relief of the poor in the parish of Whelford, in the county of Gloucester; and it was conceived to be of some importance, that the relief should be so given, as not to diminish the spur to industry. It had been apprehended that the usual mode of taking the amount of every individual's earnings, and making it up to a certain sum proportioned to the number of his family, *but having no reference to his or their industry and exertion*, might have the effect of weakening the spirit of honest labour among the poor, and habituate them to depend, not on their own diligence and care, but on parochial funds, for the support of themselves and their families.

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[*] By the Earl of Winchilsea.

The following plan has therefore been adopted by the vestry of the parish of Whelford. A certain and a moderate sum has, from time to time, according to the season of the year, been fixed as the average earnings of a labourer with common industry, working at the ordinary price of labour in the parish. This weekly sum has of late been fixed at nine shillings; being what, it was conceived, every honest labourer might aſsuredly earn, with the neceſsary exceptions of casualty, or sickneſs.

To this sum the parish has added such amount of weekly relief, as has, in the whole, enabled the cottager to purchase weekly, for each individual in family, ten pounds and a half of wheaten bread of such quality as is in general use in the neighbourhood; and has also (besides some allowance of coals) allowed sixpence a week each, for other neceſsaries. The most industrious and best disposed of the cottagers, have not applied this allowance of money in the purchase of wheaten bread; but have bought barley, and have had it ground, and mixed with wheaten flour; seldom leſs than half barley, and frequently two-thirds. In some instances they have made their bread entirely of the unmixed barley.

In this mode of relief, if labourers reap or mow by the acre, thrash by the bushel, or quarter, or do any other task work, it is obvious that they have all their extra earnings, beyond the common price of labour by the day, to themselves for their own benefit, in addition to the same allowance as others receive. Thus it happens that neceſsary relief is supplied to meet a temporary preſsure, without discouraging, but rather giving effect and value to their industry, by the extra advantages and enjoyments which they receive from it.

Besides this, the Overseers, by direction of the parish, did at Lady-day, 1800, hire fourteen acres of land, to be allotted in gardens, for the labouring poor of the parish. The quantity appropriated to each cottager, is varied in some proportion according to the magnitude of their families, and to their probable exertions in the cultivation of the ground. The largest garden contains about 60 perches; the smallest 20; except in some few cases, where there is only one, or perhaps two, in family; and then they have as little as 14 perches. If in this manner we permit the unoccupied labourer to dig up a piece of land, and to enjoy the produce of it, we benefit him and all the members of society, without injuring any one; for we increase the common stock. If we instruct and enable him to use those means of subsistence, which he doth already poſseſs with great benefit to himself and his family, the effect is nearly the same: if we diminish the waste of food in our families, and the saving is applied for the benefit of the needy, they are relieved without injury to others: but if, impelled by appearance of distreſs, without consideration of circumstances or consequences, we go to the market, and purchase provisions in abundance for our poor neighbours, we enable them to live with leſs industry, and to consume more food; and thus we diminish the means of subsistence in the country, and do a real injury to all the other poor.

The land at Whelford is a dry, healthy, warm gravel; the rent paid for it is 24s. an acre. It was intended that they should each pay a proportion of the rent, taxes excepted; but the preſsure of the times has been so severe upon the poor this season, that it is proposed to dispense with the rent this year.

This supply of garden ground is very acceptable to them, particularly to the industrious labourers, most of whom have planted part with potatoes; and although the season has been unfavourable for that root, some of these cottagers have had from 15 to 16 sacks produce, a supply that must have been very beneficial to them this winter, and of no small advantage to the parish in diminishing the call for parochial relief.

It was not a subject of surprise that, of these cottagers, some who have been long in the habit of relying on parish relief for the greater part of their support, should have neglected the cultivation of their gardens; for it has been noticed in the parish of Whelford, as well as in other parishes, " that those who, for a length of time, have been burthensome to the rates, *lose all inclination to ex-*

ertion; and endeavour, as much as poſsible, to impose on the parish officers." The overseers, therefore, do not put these cottagers in poſseſsion, as tenants from year to year; but only permit them to crop the land upon sufferance; in order that there may be no difficulty in resuming the gardens from those who shall not pay a proper attention to them, so as to put them into those hands that will cultivate them to the greatest advantage.

Such are the measures which the judicious farmers of the parish of Whelford have adopted for the benefit of a parish; where, I understand, there is no resident clergyman or gentleman, to give aſsistance, or to concur in the execution of a plan so wise and liberal, and so eſsential to the permanent interest of the landed property. With regard to the first measure, compared with the general system of relief now adopted in England, I must premise generally, that if we make it the interest of the poor to deceive us, and to live in idleneſs, we must not wonder at the neceſsary consequence, *that we are imposed upon, and that they are idle;* and when we are reasoning upon the wickedneſs of such conduct, we ought to reflect that half the criminality at least, and the entire cause and origin of it, will rest with ourselves. As to the second point, I cannot but wish the experiment were fairly tried in other parishes, whether 16l. 16s. or even ten times that sum, doled out in pecuniary pittances of parish relief, can produce half the beneficial effects that these 14 acres of ground, hired by the parish at the rent of sixteen guineas a year; and apportioned out among the industrious labourers; even with the supposition, that the hardneſs of the times will prevent the rent, at present, from being returned to the parish. Its effects are of the most beneficial nature;—the affording of satisfactory occupation to the cottager, for hours otherwise spent in the ale-house,—the habituating of families to maintain themselves,—the breeding up of the rising generation to industry and forethought, and the addition, in the instance of this one parish, and in a year of scarcity, besides other articles of food, near 2000 bushels of potatoes to the private store, and to the domestic plenty of the cottagers of that parish.

The diminution of industry and exertion, and the prevalence of indolence and thought-leſsneſs among the poor, whereof we have so frequent and so clamorous observation, are not to be imputed to the poor laws, but to the peculiar manner in which they are executed. It is, indeed, most wearisome and melancholy, to contemplate so many sad and desponding examples among the poor;—of childhood without industry;—without the use, without the knowledge, and frequently without the power of employment.—Youth without foresight and without the habit of laying up any thing as a provision for the increased demands of the marriage state; mature life with means of subsistence always inadequate to a numerous and increasing family;—and old age, receiving a comfortleſs and thankleſs subsistence, in a parish work-house.

The power of supplying regular and abundant means of support for all the aged, the helpleſs, and the unfortunate in society, seems to be an exalted and enviable prerogative. But in this, and in every other similar exercise of superior authority, constant and unremitted attention is neceſsary. If the idle and vicious are to receive the same benefit, and are to be intitled, for their wives and families, to the same support through life, as the honest and the industrious,—if there is to be no discrimination of merit or claim,—the incitement to industry and virtue will ceaſe, and the cottager will be thereby deprived of that spur to exertion and attention, which is eſsential to the well-being of society, and which constitutes his own most valuable poſseſsion.

It is therefore our duty, not to afford to the poor the means of repose and indolence, but to offer them encouragement to industry; not to increaſe the propensity to vicious indulgence, but to promote the habits of religion and virtue. To effect this, we ask no additional regulations,—no new *experimental* poor laws,—*no accumulation of penalties on misconduct.*—We seek only this, that the poor-rates of this kingdom shall be gradually reduced by the adoption of a new system with regard to the poor;—by increaſing their resources and means of life, and thereby placing them above the want of parish relief;—by watching with a benevolent eye over their conduct and neceſsities;—by opening in every parish, schools for poor children, and a poor house, not liable to the ordinary and popular objections;—and by imitating the wisdom and philanthropy of the farmers at Whelford; and so administering parochial relief, as eventually to diminish the call for it; and to make it subservient to the great and primary object,—of promoting virtue and industry.

5. *Preliminary.*

As I do not consider the GEORGICAL ESSAYS as confined to the operations going forward upon the surface of the earth, I hope to be allowed occasionally to take a view of the internal parts of the globe, that derive no advantages from the cheering rays of the sun. And as it is my intention to conclude these Eſsays with an account of the diseases and condition of persons employed in husbandry, I flatter myself that I shall be permitted to exhibit a view of the mining poor, whose situation, from the nature of their employment, is often most truly uncomfortable.

EDITOR.

*On the situation of the Mining Poor**.

The respective occupations of the different claſses, into which the poor of this country may be divided, are found to produce important effects, not only on the habits of life, but also on the moral character of each claſs. To state with brevity the principal of these effects, as they severally appear exemplified in two or three of the most numerous claſses, together with some practical remarks, may not be useleſs: since, from such a statement, persons, who are solicitous to befriend and improve the poor in their vicinity, may derive occasional suggestions as to the particular channels, in which their exertions are likely to be the most needed, and most beneficial.

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* By the Rev. Thomas Gisborne.

Miners are commonly exempted, by the nature of their work, from the superintending inspection of their employer. The latter, in consequence, finds the mode of paying them a certain sum per day unadvisable. He sets them their task by the great, suiting the mode to prevailing custom and other local circumstances. In Derbyshire, the workmen frequently take a mine, or a bargain for a determinate period, as three months, on the terms of receiving a settled price for each measure of ore which they shall produce, or occasionally, on the condition of being themselves allowed to purchase all the ore at a stipulated rate. In Cornwall, the established course of proceeding is not substantially different. Hence there is a fundamental diversity between the gains of the miner and those of the husbandman. The husbandman, in general, earns a fixed sum per week. If he sometimes undertakes task-work, the amount of his earnings may still be foreseen with tolerable accuracy; and it has a known limit in the strength of his body, and in his skill in the particular sort of work. But the pay of the miner depends upon chance. The working miner is almost always in some measure a gambler, and embarks in the adventure of the mine. The ore may be found deposited in ample or in scanty veins; may be with ease, or with great difficulty, detached from its bed; it may stretch far and wide in an unbroken range, or it may be suddenly removed many yards to a higher or a lower level. Even in breaking up ground which does not contain veins of ore, the miner is still a gambler. The work is put up to a kind of auction; and the person who will undertake it on the cheapest terms is preferred. His bargain proves good or bad, according to circumstances. He may find himself engaged upon a maſs of soil, which yields readily to his spade, and pick-axe; or retarded in his progreſs by rocky strata, whose stubborn opposition must be overcome by gunpowder.

The earnings however, of the miner, though precarious, are on an average great; and in many instances very far exceed all prospects of gain, which a labourer in husbandry can propose to himself. Those miners who are industrious, and at the same time frugal, often make a conspicuous use of the opportunities which they poſseſs, of improving their situation. With the surplus of their gains they purchase little spots of property (in Cornwall chiefly on leasehold tenures) and cultivate them in their hours of leisure. So circumstanced, they are kept from alehouses, by finding, in their own little property, amusement and occupation for their vacant time; they acquire habits of forethought, because they enjoy the benefit of it; and become orderly and civilized in some measure, because they derive an additional motive to behave aright, and consider their conduct as more subject to observation, in consequence of their being poſseſsed of property.

But, in common, the miner is not disposed to adjust the scale of his expenses to the *average* of his earnings. Being accustomed to the occasional receipt of considerable sums of money, money too which has flowed in suddenly upon him, rather from good fortune than from proportionate exertions, he often raises his expenditure and mode of living to a pitch, to which the labourer in agriculture ventures not to aspire. He feeds on better diet, and wears clothes of finer materials, than the husbandman. And, in general, he persists in this manner of life, in spite of a change of circumstances. He is buoyed up with the sanguine hopes of a gamester: and, for what he cannot pay to-day, draws on the favourable luck of to-morrow. This natural propensity is cherished and aggravated by the ease with which he obtains credit, in comparison of those claſses of labourers, whose gains, though steady, are limited. If he happens to be unsucceſsful, he is trusted neverthelefs at shops, and permitted to run up long scores at public houses; through the hopes entertained by the shopkeeper and the publican that a day will come, when fortune will smile on the debtor. Thus the habits of the miner are seldom interrupted by any rubs and difficulties, which may teach him caution. He has leſs occasion than most other men to dread the immediate inconveniences of poverty; and does not willingly learn the neceſsity of frugality and forecast.

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Drunkenneſs is a vice, to which particular claſses of workmen are allured, in an especial manner, by the nature of their employments. Blacksmiths, glaſs-makers, and they who labour in other ways at the forge and the furnace, are led, by intense thirst and exhaustion of strength, first to the use, and then to the abuse, of strong liquors. The cold and dampneſs of subterranean situations, and in some measure the powerful exertions of subterranean labour, produce a similar effect on the miner. Several other causes concur; numerous and unprincipled society, large gains, and in many cases, much vacant time. In Derbyshire and Cornwall, the miners frequently do not work above six hours; and, in the former county, sometimes even but four hours in a day. The ease, too, with which a miner has obtained credit, often proves a temptation to exceſs. He, who has met with a friend in the time of need, in the keeper of an alehouse or of a brandy shop, will feel inclined, when he has money, to spend it freely at the house of his friend, partly from gratitude, and partly from the hope of obtaining credit hereafter. Another inducement to drunkenneſs remains to be mentioned; namely, the custom which prevails in some few places, of paying the miners on Saturday evening, by a bill for a sum, which is to be divided among them. These men, however disposed to depart home with their wages entire in their pockets, are absolutely forced to go for change to the neighbouring public house: the master of which is known regularly to provide himself with cash, to answer the demand. During the division something must be spent. From this custom many miners, once sober and well disposed, have probably had to date the commencement of habits of ebriety.

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their childhood. A young mining labourer takes a hasty liking to one of these young women, and marries her, without thinking about consequences. This is the history of a multitude of marriages among miners; and, circumstanced as the parties are, it is natural that the case should be so. The wife, however, is not likely to have found the mine an excellent school, either of virtue, or of economy. Nor is it, in consequence, very surprising that waste, profligacy, and dram-drinking, should be almost among the ordinary habits of a miner's family. The daughters of the husbandman are commonly brought up much more under the eye of their mother. They help her in nursing and spinning, and other occupations at home: and when they go out to work in the field, it is frequently in her company. They stand therefore a better chance of being trained in morality and religion, and the arts of female industry: and become habituated to that economy, and those various contrivances, which actual neceſsity forces on the wife of a day labourer. They of course will, in general, make more virtuous and more prudent wives, than young women who have been accustomed, from an early age, to the company and example of the mixed crowd of their own sex and of the other, which is usually aſsembled at the mine and the stamping mill.

The colliers in the vicinity of the Tyne form so large a body of men, and shew so strongly marked a character, that some distinct account of them seems proper to be subjoined.

Few undertakings open the door so soon to the employment of the young, and few operate so powerfully to impreſs durable habits on the mind of youth, as the coal trade.

Boys enter the subterranean workings at the age of six or seven, in the character of *trap-door-keepers*, an employment suited to their years; the labour being little more than to open and shut doors, fixed for conducting air round the various works, when the coals are paſsing through them from the workmen to the shaft.

In this situation they remain four or five years, with little intercourse during the hours of labour (which are from 12 to 18 out of the 24) either with their equals in years, or with their superiors; and hear little that can influence their minds, except the noise of imprecations spreading through the works, from the pitman contending with his overseer, down to the half-grown youth, employed in leading the coals from the workmen, and imposing upon his younger partner in the labour a disproportionate share of the work, to procure ease to himself. When they reach the age of ten or twelve years, a more laborious station is allotted to them.

They then become what are termed *lads or foals;* supplying the inferior place at a machine called a tram, where two are employed in drawing the coals from the workmen to the shaft. In this situation they are subject to the most harsh usage from their superior in the work, who frequently forces upon them, with profane and abusive language, followed by blows, a greater share of the labour than they are able to perform. Hence, in order to avoid punishment, they soon learn habits of deceit and evasion; and scruple not to practise them, whenever they seem expedient, at the expense of truth and honesty. And when the period arrives, which places them in the station from which they have received so much abuse, they seldom fail to retaliate on those, whom progreſsive advancement from the trap-door to the tram, brings into their power.

In every subsequent step towards manhood, they consider it as a merit to deceive and overreach.—In their next stage of occupation they are employed, during one half of their time, *in putting and drawing* the coals: and, during the other half, in raising the coal from its bed. Here a wider field opens itself to the display of their ingenuity, in the art of evasion; and new incentives impel them to the exercise of it.—Let loose from even that small degree of restraint, under which they considered themselves as held by the authority of their parents, (for at this period they generally become their own masters, having the full disposal of the product of their labour,) and inflamed with the growing paſsions of youth, they indulge themselves, with the most vicious emulation, in the scenes of intemperance and profligacy. If they are, at any time, without the means neceſsary to procure those indulgences, they study to avail themselves in their respective departments of every artifice (however injurious to the interest of their employer) to complete their purpose. Thus by slow but perceptible degrees, the mind becomes poisoned with wicked principles and guilty habits.

The hours devoted to what they term their amusement, are not leſs prejudical to the moral character.—At a very early period in life they attend the haunts of their fathers at public houses; where their growing fondneſs for strong liquors is encouraged, rather than checked, by their parents; and the child soon becomes a man in the frequency of intoxication. To gratify this paſsion for intemperance, which is a leading characteristic of pitmen, they endeavour to enhance the price of their labour by every art in their power; and in this, as well as in every other transaction with their employers, easily sacrifice the principles of rectitude, to promote their selfish designs.

The early age at which the child is separated from the parent, and the little communication which they have with each other afterwards, visibly impair those affectionate feelings, which constitute parental happineſs.

They seem to consider their children chiefly in the light of servants and dependents, from whose labour they expect to reap advantage; and are little solicitous to impreſs on their minds, habits of sobriety, honesty, and truth; and thus to train them in the paths of religion.

For the purpoſe of inculcating Christian principles, Sunday schools have been established. While the institution was novel, they were numerously attended.—As soon as that impreſsion lost its influence, they became far leſs frequented. And no representations of the good effects of such institutions, have been sufficient to prevail upon the parents to enforce attendance by their authority. Even where daily schools have been established by some of the opulent coal-owners, the pitmen frequently do not give their children the advantage of that little education, which might there be obtained, antecedently to the period when they enter the pit.

When the principles are thus habitually depraved, it is not to be expected that much attention will be paid to the duties of religion. By most, even external forms are disregarded; and the time, which ought to be spent in attendance on Divine worship, is generally dissipated in frivolous pursuits, vulgar athletic exercises, or in drinking at public-houses.—Where attention to religion prevails, the good effects are manifest.—Colliers of that character are usually sober, industrious, honest, and frugal, both in themselves and in their families.

Another trait, in the character of a collier, is his predilection to change of situation. Whatever may be the comfort and conveniences resulting from his connection with any particular employ, he sacrifices them all to his love of variety, and the hope of superior adadvantage; so that annual changes are almost as common with the pitman, as the return of the seasons; and, not unfrequently, the succeeding year finds him in the same situation, which he quitted twelve months before. And whatever favours he may have received, he is disposed to consider them as all cancelled by the refusal of a single request.

It is to high wages, that many of the criminal habits, so often attached to the character of a collier, may in part be ascribed. He is furnished with the power of obtaining more than the neceſsaries of life; and being destitute of the principles, which would teach him to apply the surplus to proper purposes, he squanders it in the gratification of groſs sensuality. To economy he is, in general, an utter stranger. It is no unusual thing to see a man and his family, during the first week after they receive their wages (which are commonly paid to them once a fortnight) indulging themselves in the use of animal food three times a day; and in the succeeding week living on a little rye bread, with oatmeal and water, until the next receipt of their wages enables them to return to a course of luxury. The contrast between the pitman and the labourer in husbandry, is very striking. The latter, with 9s. a week, is seen keeping himself, his wife, and several children, from whose labour he reaps little advantage, with all the appearance of decency and frugality; and even allowing out of his wages something for the education of his children; while the former with 16s. a week, and often more, together with the labour of his family (which, if it consists of three or four boys, brings him in from 20 to 30s. a week in addition to his own gains) paſses half of his time in luxury and riot, and the remainder in filth and poverty. The manners of the pitmen are said evidently to have altered, within a few years, materially for the worse.

As the preceding account of the colliers does not represent them in an attractive light, it is the more incumbent on me to say, that I speak from concurrent information, derived from different sources, each of high authority. Many exceptions to the general description undoubtedly exists, The preceding statement contains facts of such a nature, that the perusal of it will probably suggest to the reader several practical remarks. There are, however, some points, on which it may be useful to add a few words.

The first evil, in the situation of miners, which ought to be remedied, is the very little education and religious instructions, which their children in general receive. How are these children, when they compose in their turn the next generation of the mining poor, to discharge their duty to God and man, if they are not impreſsed early with the principles, from which the sense of religious and moral obligation flows? The institution of Sunday schools is one excellent mean for the attainment of the object in question. Every poſsible encouragement ought to be given to them, and persuasion and little premiums and all other fit inducements should be employed, to secure the regular and cheerful attendance of the scholars. Another method of improving the parent, as well as the children, has been recently and deservedly recommended by an eminent prelate *; namely, the erection of additional cha-

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* See an excellent charge lately addreſsed by the Bishop of Durham to his clergy.

pels in populous districts. Let it here be generally observed, that, in every plan for improving the character of the mining poor, the proprietor of the mine and the clergyman of the place ought cordially and actively to cooperate. Each has it in his power to contribute to that improvement; and, in proportion to his power, each is responsible.

The predominant vice of drunkenneſs calls for the most vigilant counteraction.—Let the number of public houses be reduced within as narrow limits as convenience will permit: and the conduct of publicans be carefully observed by the gentlemen and magistrates of the country. Let the very pernicious custom of paying miners by a bill to be changed at the public house, be immediately abolished. The temporal distreſses, which result from ebriety, afford arguments proper to be urged to individuals, in proportion to their intrinsic force. But I know no method of recalling guilt to the path of rectitude, either in public or in private life, likely to be durably efficacious, except this: first, to impreſs the mind with a conviction of the truth and awful import of Christianity; and then, to point out the bearings of Christian commands and prohibitions on the particular subject, with respect to which you wish to accomplish a reformation. He who, under the impulse of brutish appetite, disregards all considerations of injured health, wasted property, a heartbroken wife, and starving children, may pause, tremble, and be reclaimed, when he sees that the "*drunkard*" has his place in the dark catalogue of those, who, "*shall not inherit the kingdom of God!*"

The use of profane language may be in a great degree depreſsed by care, on the part of the proprietor, to appoint conscientious agents and superintendants over his works. I could name more than one instance of captains of men of war, who, by suitable penalties and personal exertions, have almost eradicated that vice from their ships. Why should it be more difficult to be subdued in a coal-mine?

Deceit appears to be among the general faults of miners. It is stated as one of the characteristics of the Newcastle colliers: and a similar reproach is applied to the miners in Derbyshire, who are said, by practice, to have attained great adroitneſs in disfiguring the sides of a mine, when the time, for which they have taken it, is expiring, that the owner may be entrapped into a new bargain advantageous to the workmen. By a due choice of agents, let the tyranny of the elder partner over his colleague at the tram, one principal source of deceit, be prevented. And, universally, let the love of truth be habitually encouraged, and traced up to Christian motives.

In opposition to the spirit of mutiny and discontent, it may easily be shown, and it ought to be inculcated, that no principles are, on the one hand, more adverse to turbulence and anarchy, nor, on the other, more favourable to genuine freedom, than those of the religion which we profeſs; and that corresponding praise belongs to those of the constitution under which we live.

The propensity to change of situation, which prevails among miners, to the detriment of themselves and their employers, will be best encountered by solicitude, on the part of the proprietor, to attach his workmen to himself, by rendering their condition comfortable. Let him make their cottages neat, and moderately commodious, adding to them ample gardens, and affording to each family an opportunity, as far as may be practicable, of keeping a cow, or of purchasing milk: let him study to allure them to habitual cleanlineſs, when above ground. Let him invite them to forecast, by encouraging the establishment of friendly societies; the advantage of which to miners is the greater, on account of the frequent accidents to which they are exposed: and let him promote similar institutions for the benefit of widows and orphans. Let him set up schools, where the girls may be instructed in sewing, knitting, and spinning, and those little domestic arts, which will be of the utmost utility, when they become wives and mothers. By abundant ventilation, and other suitable contrivances, let him render the different subterranean occupations salubrious, and as free from disagreeable circumstances of every kind, as the nature of the case will admit.

6. *Preliminary.*

The powerful examples here given of the method of bettering the condition of the poor Cottager and Miner, will be weakened, in a great degree, unleſs the Overseer pays a proper attention to the nature of his office, which unfortunately is limited to a short duration, and consequently expires at a time when he is just beginning to know the nature of the duty that he has undertaken. I presume that some instruction given him on entering upon his office, will qualify him, at an early period, for the due performance of it, and be the means of his leaving it with credit to himself, and advantage to the poor, over whom the laws of his country have placed him, as guardian and protector. The following charge is well calculated for this purpose, and is highly honourable to the Gentleman who gave it.

*The Charge**.

SIR,

The office, to which you are this day appointed, is of no small importance, inasmuch as the welfare of a considerable part of our fellow-subjects depends upon the due execution of it. It is *your* duty, Sir, to be the GUARDIAN AND PROTECTOR OF THE POOR;—and, as such, to provide employment for those who *can* work, and relief and support for those who *cannot*; to place the *young* in a way of obtaining an honest livelihood by their industry, and to enable the *aged* to close their labours and their life in peace and comfort

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* By Thomas Bernard, Esq.

In the execution of this office, it is your duty to consider how you may best *improve the situation of the poor* in your parish, so as to leſsen the calls for parochial relief, and thereby to diminish your parish rate.—In this respect, much may be done by *occasional* aid and encouragement to parishioners with large families; much, by means of regular employment for children, either at home or in schools of industry, so as to fit them to be placed out in service at an early age;—and much, by a judicious management of your poorhouse, if you have one, and by making a proper distinction and separation between the honest and industrious who are driven thither by age, infirmity, or misfortune, and the idle and profligate, whose loose and vicious habits of life have made them a burthen and a disgrace to their parish.

You are, Sir, within the space of 14 days, to receive the books of aſseſsments and of accounts from your predeceſsors, together with such money and materials, as shall be in their hands; and, if any balance is due to them, you are to pay it out of the first monies that come to your hands.

In conjunction with the churchwardens of your parish, you are, by a parish rate, to raise money, to purchase a sufficient stock of materials for setting the poor to work, and to supply competent sums for the relief of the lame, impotent, old, blind, and such among you as are poor and unable to work, and for putting out poor children apprentices.

In making the poor's-rate, it is neceſsary that a majority of the churchwardens and overseers should concur; and it is your duty to make an equal and impartial rate, without favour or affection, upon "every *occupier* of "lands, houses, tithes, mines, and saleable un-"derwoods in your parish." When such rate is made, it is to be approved and signed by two Justices, dwelling in or near your parish; and, on the Sunday after, to be published in your parish church.

In case the rates, so made, shall not be regularly paid, you may obtain a summons for the person making default to appear before two neighbouring Justices; who may, by warrant, authorise such rates to be raised by diſtreſs in your pariſh; or, if ſufficient goods of ſuch perſon making default be not found in your pariſh, then, upon application to one juſtice, to be levied in any other county, or diſtrict, where the defaulter may have property.

With regard to the *poor's-rate*, we know that there are inſtances, in ſome parts of England, where it has been levied upon the *poor:* we mean, by the poor, thoſe who have not the advantage of any profeſſion, trade, property, or income, nor any other means of ſupport, except their daily labour; and who have only a cottage, a little garden, and a few articles of furniture, merely ſuch as are neceſſary for them and their families; and we think it our duty to obſerve, that, to charge ſuch poor perſons to the rate at all, appears to us to be directly contrary to the authority, under which the rate is made; viz. the ſtatute of Elizabeth, which was paſſed ſoon after the diſſolution of the monaſteries, and entitled "an Act for the *Relief* of the *Poor:*" An Act, in which, if *cottages* had been intended to have been included, they would have been expreſſly named, as well as *houſes;* from which they were then conſidered as totally different, and diſtinguiſhable in point of law.

It is impoſsible to read that ſtatute without perceiving that it was never intended to compel the *poor*, who are frugal and induſtrious, to ſupport thoſe who are not ſo; but that there is, throughout, a diſtinction made between the claſs of men, not having income or property, who are to be *entitled* to relief under it, and thoſe who, from the income of their property, profeſsion, trade, or occupation, are to *contribute* to that relief:—that by the *poor* are intended the labouring cottagers; who, if out of employment, are, under that Act, to have work found them;—if lame, impotent, old, or blind, and unable to work, are to receive pecuniary or other relief;—who, if habitations are wanting, are to have them erected at the charge of the pariſh;—and whoſe children, if unemployed, are to be ſet to work, and, at a fit age, to be placed out apprentices in ſervice, or to a trade.

But, whatever may be the opinion as to the *law*, there can be no doubt in point of *prudence*, that while the day-labourer, who has children, is exerting himself to maintain his family without parochial aid, it is a dangerous experiment to attempt to make him contribute to the support of your other poor, with the probable, or even a poſsible, consequence of driving a large family on the parish.

There is, however, one claſs of labouring men, who have still a superior claim to exemption from parish-rates;—the Members of Friendly Societies, who are acquiring for themselves, out of the savings of their own industry, an eligible and honourable provision, independent of the poor laws. As these societies, particularly *where they enjoy the advantage of having their rules framed and confirmed according to law,* have the effect of greatly reducing the poor's-rate, it is required of you, as an act, not merely of *justice,* but of *prudence,* not to *endeavour,* in any case, to compel such labouring men, being Members of Friendly Societies established according to law, to contribute to the support of *the other poor* of their own parish.

In applying the rate for the relief of the poor, we request that you will attend to the *permanent improvement* of their condition, rather than to the little expedient or economy of the moment.—If a poor man's family is visited by sickneſs or calamity, it is better for your parish that he should receive a timely supply of medical and other neceſsary aſsistance at home, and be re-established in the power of maintaining himself and his family by his labour, than that they should be neglected, until it becomes neceſsary to remove them into the poorhouse, where they may probably remain, a burthen to the parish, for many years:—If the poor of your parish want employment, there is more economy in supplying them with instruction, encouragement, spinning-wheels, wool, and other means of earning a livelihood, than in leaving them to be oppreſsed by poverty, and by that languid and desponding indolence, which is often rather the misfortune than the vice of the poor; with the consequence of being obliged to maintain the family afterwards, at ten times the expense, that would have been incurred at first, by a timely supply of relief to themselves. Upon this head, we have one earnest request to make; that whatever is made by their labour, they may have the *whole produce* of it, without any deduction, on any pretence whatever.—The earnings of the poor should be sacred and inviolate, in order to encourage them to work, and to exempt the character of their employers from the imputation of interested motives.

Upon the authority of the case of the *King and North Shields* (20 Geo. III.) we have, where parents have applied for support for their infant children under seven years of age, ordered them relief at home, without removing the parents or children into the parish workhouse; adopting the humane and judicious sentiments, which Mr. Justice Buller delivered on that occasion:—that it would be injurious to parishes, if, " when *one* of a numerous fami-" ly wants relief, the *whole* must go to the pa-" rish workhouse;" and that it would be very unjust " that the parish should be entitled to " the labour of a *whole* family, because *one* of " them might want relief."—Any difficulties, however, that did exist on this subject, have been removed by the act (36 Geo. III. cap. 23.) which enables magistrates to make special orders for the relief of industrious poor persons *at home*.

It is your duty, Sir, to see that there are proper habitations for the poor of your parish; and if, by the decay of cottages, or by the increase of population, more habitations are wanted for them, you are, with the leave of the lord of the manor, to erect cottages for them at the parish expense, on the waste or common, within your parish.

After every thing has been done for the encouragement and protection of the deserving poor, there remains another claſs, which it will be neceſsary to reform by punishment; I mean those drones of society, *idle* and *disorderly* persons, whom the law has described as *vagrants*, *rogues*, and *vagabonds*. It is due to the honest exertions of the industrious cottager, that, while he receives aid and encouragement, they should not escape correction; that every distinction should be made between him and those, who wander about, endeavouring to subsist, without labour, on the industry of others; of whom many have deserted their families, and almost all have quitted the place, or situation, where their services might have been useful, and where they ought to have been employed. In bringing these to punishment, with a view to amendment, it will be prudent for you to apply for directions to this bench, where you have found regular attendance and aſsistance from the magistrates for the space of nine years; and it will be merciful so to select the objects, as that the punishment of few may have its effect in the reform of many.

As in your conduct towards the poor out of the workhouse, so, in respect of those within its walls, there should be a *marked distinction* between the *industrious* and the *idle*, and between the *orderly* and the *profligate*. There is nothing in the internal regulation of this country, more subversive of its credit, or more inimical to its prosperity, than the uniform and unvaried treatment, which the best and the worst of our fellow-subjects receive in a parish workhouse. In that place, it is of the utmost importance, not merely to the poor persons who are driven thither by the tempest of fortune, but to the very well being of the country itself, that there should be a decisive boundary—a line of separation—drawn between the *industrious* and *honest* poor, who are suffering under a calamity from which neither you nor we can presume to be exempt, and those *vicious* and *abandoned* characters, which are the pests of society, and the objects of punishment.

In administering relief, we inquire into the industry and character of the person who applies. We have found no small benefit in adhering strictly to this rule; and we confidently recommend to you, as an encouragement to the energy and good habits of the poor, not to give to the idle and the vicious the same encouragement, as is due to the honest and industrious labourer, suffering under ſickneſs or misfortune. If it appears that the person, who applies, has exerted himself *honourably* and *diligently* in his situation, it is your *duty*, Sir, and it is the *interest* of your parish, that he be relieved *kindly* and *liberally*.

There is an Act of Parliament, which enables you, *if you are so disposed*, to farm your workhouse.—It is poſsible, that a *farmed* workhouse, confided to a deserving person, *like absolute power in the best and most virtuous hands*, may be the instrument of good; but there is no instance whatever, in which the *duty* and *interest* of the person *intrusted* are so completely in opposition to each other, as in that of the farmer of a parish workhouse. For, while his duty should direct him to improve the state of the workhouse, it is his interest to keep it in such a condition, as to deter any competitor from offering for it, at the end of the year.

The neceſsary consequence of this is the increase of parochial expenses: and we find, from the different returns throughout the kingdom, that, where workhouses have been farmed, though there was some saving at first, yet in a few years the expenses have thereby been greatly increased, and the poors-rate accumulated to an alarming amount. Where, indeed, a principal land-owner, or land-occupier, of a parish can be induced to contract for the parish workhouse, *he has an interest in the permanent improvement of its condition*, and in the diminution of the distreſses of the poor; but where a *vagrant speculating contractor* visits your parish, with a view of making his *incidental* profit by farming your workhouse, we trust you will consider the Christian principle of DOING AS YOU WOULD BE DONE BY: and that you will not confide the poor, whose GUARDIAN AND PROTECTOR it is your duty to be, to one, into whose hands you would not trust an acre of your land, or any portion of your own property.

With regard to your workhouse, we have another observation to make, and that respects your parish children.—As you regard your own interest and their welfare, we entreat you to educate them *out* of the workhouse. You can do it with as little, and even leſs, expense to the parish; with much leſs annoyance to the old people in the workhouse, who are too often the sport of those little, unthinking, and uneducated creatures;—and with much more benefit to the children, who get earlier and more advantageous situations in service, and succeed better in life, proceeding from a parochial school or cottage, than from a workhouse.

With regard to the removal of labourers belonginging to other parishes, consider thoroughly what you may lose, and what the individual may suffer, by the removal, before you apply to us on the subject. Where you have had, for a long time, the benefit of their labour, and where all they want is a little *temporary* relief, reflect whether, after so many years spent in your service, this is the *moment* and the *cause*, for removing them from the scene of their daily labour to a distant parish. There are cases, in which removals from one parish to another are proper and juſtifiable; but, in every instance, before you apply for an order of removal, consider whether it is *prudent*; and, if prudent, whether it is *just*.

Within four days after the appointment of your succeſsors, you are to produce your accounts before two of the neighbouring Justices for examination; and, within fourteen days after such appointment, you are to deliver your books, materials for work, and balance of cash, to the persons appointed to succeed you.—If you shall have executed your office duly and conscientiously, you will then quit it, with the bleſsings of the poor, the esteem and respect of the other claſses of society, and with the approbation of your own conscience.

7. *On the situation of Cottages, with a Plan for enabling Cottagers to build them**.

There are few parishes without several rough, encumbered, and uncultivated tracts of land, which might be converted into large gardens, and on which cottages might be erected, either by some of the poor themselves, to be held on lives, or at the expense of the parish, or of the proprietors of estates. Where there is no land uncultivated, other grounds, which can be most conveniently spared, should be allotted to them. Many young men, having saved a little money, would be very desirous of taking such spots of ground on leases for three lives, and of building cottages thereon. I have frequently remarked that the labourers who poſseſs this kind of property, are the most industrious, sober, and frugal; that they seldom apply to their parishes for relief, and that their houses have an appearance of neatneſs and comfort, not often met with elsewhere. If these were more attainable by the poor, frugality would revive amongst them, and young people would strive to lay up a sum of money for this purpose. Every labourer poſseſsing such property of his own, would consider himself as having a permanent interest and stake in the country. The hope of improving their lot is the main spring of industry in all other stations in life. Would it not then be policy as well as humanity, to afford to the agricultural poor the same opportunity? The wealth and greatneſs of this country has been attributed, not only to the spirit of enterpriſe of our merchants and manufacturers, but to the effect which the poſseſsion and the security of property, enjoyed under our free and excellent constitution, have on the minds of men. If this effect has been so salutary among other claſses, why may not similar encouragement create the same energy among the cultivators of the land; and why should those alone remain in a dispirited, and distreſsed state?

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* By William Morton Pitt, Esq.

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nough to estimate it, at an average, at
acre; where the land is better, a higher
ay be added without injustice; for, the
ter the land, the greater will be the advantage to the leſsee from its produce as a garden. The quantity of land to be attached to such a cottage should be half an acre; if it be more than sufficient to produce the vegetables wanted for a family, a part of it may be sown with a little wheat for bread, pease to fatten the pigs, and barley for malt, to enable them to brew a little small beer; the want of which induces many to frequent the alehouse, and proves the source of vicious courses.

The corn in these gardens should be raised by dibbling, which is already very much practised in many parts of the kingdom. The cultivation of the garden will be chiefly conducted by the wife and younger children of the family, (who will thus very soon contribute largely to their own support, if not wholly maintain themselves, so that a numerous offspring will cease to be a great burden,) to which must be added a certain proportion of aſsistance from the father, at his extra hours. Where 10s. an acre is the value of the land, 5s. per annum must, of course, be added, for the half acre of ground, to the quit-rent for the house. Let that be 5s. and the whole annual payment will be 10s.; and, when it is considered that the proprietor of the estate has been at no expense whatsoever in building or repairing the cottage, and that he receives annually the quit-rent for the house, in addition to the full rent of the land on which it is built, I think the fine, to be required in putting in a life, should not exceed one year's purchase, computed on the real value. The cottager then, who builds a house upon this principle, acquires the following advantages; permanency of property, that all improvements are for the benefit of himself and his family, respectability of situation, a diminution of annual expenditure, and that he cannot be removed under any circumstances.

This arrangement will answer in all cases, where a labourer has a sufficiency of money to enable him to build a cottage; but that cannot be the lot of all. Yet a plan may be devised, by means of which, a man, having but a small proportion of the sum requisite for such an undertaking, may be enabled to adopt it. The owner of the land may, without risk, advance to any labourer in want of such aſsistance, 10l. or even 15l. towards carrying on his work, not to be paid to him in money, but laid out for his use as wanted, in the purchase of materials, or in wages to the workmen whom he is obliged to call in to aſsist him in the construction of his house. The cottage itself would be a sufficient security for the loan; since the money will only be iſsued, in proportion as the work advances. The cottager should pay interest, at 5 per cent., and part of the principal, at least 10 per cent. every year. If he fail in making these payments, his effects should be liable; or, if the demand be not otherwise satisfied in a reasonable time, the house itself. The sooner he discharges his debt, the better it will be for him, and he will look forward with impatience to the time of its liquidation that he may enjoy the effects of his industr and so comfortable a situation. In 10 years however, at all events, he will be clear from incumbrances, and in the meanwhile he wil have to pay each year not more, and, in many parts of England, not so much as he would have given as annual rent for an ordinary cottage. The landlord would also be benefited, by being relieved from the expense of repairs, and by the reduction of poor's-rate; he would receive his quit-rent annually, and a fine from time to time, in addition to the full rent of his land, as well as 5 per cent. interest on the money lent, the whole debt being discharged in 10 years at farthest.

8. *On the larger sort of Cottages, and the mode of erecting them**.

The larger sort of cottage, which may sometimes be preferred, will cost, when built of brick and tiles, 70l. These might be appropriated to the use of labourers of the most industrious disposition. And, as it would have an excellent effect to make some gradation among cottages, as well as farms, it would be highly proper, and useful, to lay (besides half an acre of garden-ground) a small portion of pasture-land, about 3 acres, to each of these larger cottages, to enable the occupiers of them to support a cow; which would be a real comfort to their families, as milk is the natural food of children. If we value these three acres and an half of land at a guinea an acre upon an average, and add it to the rent of the house, it will bring the rent to 6l. 9s. 6d. The value of the cow, if her produce were even sent to market, would at least amount to 4l.; but being used in the family, would, with the aſsistance of the garden, enable them to keep a sow, or two store pigs, which would at least double the market price. As one acre or more of this ground might be mowed every year for hay, the cow might be kept in good order with this quantity; and it would be better worth a cottager's while to give this rent for this lot of land, than to trust to the precarious advantage of a common, which always starves his cow in the winter. If it should be alleged, that there is not one cottager in twenty who can afford to buy a cow; this difficulty may be easily obviated, by the landlord's letting him a cow, as well as the land, in the manner that dairies are generally let.

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* By Nathaniel Kent, Esq.

This would be dealing with the poor as we would wish to be dealt with ourselves, in a similar situation; but, instead of this, cottagers are chiefly left by gentlemen to the farmer's disposal; and, when they are accommodated with a small quantity of land, are obliged to pay, at least, a *double* proportion of rent for it, to what the farmers pay themselves.

Warm cottages of this sort would require much leſs fuel than those in the present stile, which is a very considerable article to a cottager.

The next consideration is, to choose a convenient situation for cottages. Great farmers are very unwilling to admit them close to their farms; and nothing is more common, than for a poor labourer to be obliged to come a mile, and sometimes more, to his labour, and return home again at night, in all kinds of weather, after he has done a hard day's work. Cottages should therefore be erected, if poſsible, on some sheltered spot, near the farm where the labour lies; and true policy points out, that every farm ought to have a sufficient number of such useful appendages, in proportion to its size. Such cottages, under some such regulations as these, would be of great use and ornament to a country, and a real credit to every gentleman's residence; as, on the contrary, nothing can reflect greater disgrace upon him, than shattered miserable hovel, at his gate unfit for human creatures to inhabit.

Upon encouragement like this, good tenants would never be wanting. Industry would meet with a reward, the poor-rates would neceſsarily be lightened, and population increased. A farm thus provided with such a sufficient number of labourers as might, at all times and seasons, be depended upon, would be of more value on that account. The tenant of such farm would not be subject to pay exorbitant wages, as he otherwise must, on particular occasions. He would not be obliged to court the vagrant, to lend him a precarious aſsistance, or to have recourse to towns, to pick up disorderly people. In summer, besides the usual busineſs of haymaking, he might employ even the women and children, in weeding, and other usual busineſs.

Almost every parish is, in a great measure, subject to some particular gentleman, who has sufficient power and influence over it, to correct the present grievance, and to set a better example. Such gentlemen should consider themselves as guardians of the poor, and attend to their accommodation and happineſs: it is their particular busineſs, because they and their families have a lasting interest in the prosperity of the parish; the farmers only a temporary one. If a gentleman's fortune be so large, that he cannot attend to objects of this sort, he should, at least, recommend the cottagers to the attention of his agent; and give him strict instructions to act as their friend and protector; for unleſs some such check be put upon great farmers, they are very apt to contribute to the demolition, instead of the protection of cottages; and when the nest is destroyed, the bird must emigrate into some other parish. A cottager, in this case, has no other choice, unleſs it be to make application to the neighbouring justice of the peace, for his order to the parish-officers to find him some other place to lay his head in. If it were not for this excellent law, which obliges parish-officers to find habitations for their poor, I am sorry to remark, that in many parishes, they would be literally driven into the open fields.

There is another plan relative to cottages, which generally answers extremely well, and that is, to lease them off to industrious labourers, for the term of three lives, at their nomination; taking a very moderate fine, not exceeding 10l. or 12l. upon a cottage worth about 40s. a year; reserving a small quit-rent, not exceeding half a crown a year, and making it a point to renew any life which drops off, upon one year's value only. This scheme is beneficial for landlord and tenant; for though the farmer does not let his cottages for so much as he might at rack-rent, yet what he does get is all clear money; and by this means he preserves the value of all other parts of his estate, by keeping up a proper number of inhabitants. The latter finds his account in it, because he makes a settlement for his family; and can repair and improve his cottage at leisure hours with his own hands; and if he be an industrious man, he can generally find a friend to lend him his first fine on such an occasion, if he cannot raise it himself.

I should recommend that cottages should be built double; because it will be a considerable saving in the expense of their erection.—Where pollards are plenty, and bricks scarce, it will sometimes be proper to prefer the wooden-lath and rough-cast cottages, because half the quantity of timber may be pollards; but, where they are built with brick, the following particulars should be attended to.

The walls should be fourteen inches thick to the bottom of the chamber-floor, except in the window-spaces; and the upper part of the walls nine inches. In these brick buildings no framed timber should be used: but the lintel of the windows should be laid the whole length of the building, nine inches scantling by two and a half; and then the same piece will serve to lay joists upon, which should be pinned with oaken pegs, which will prove a great tie to the walls. The joists should be cut eight inches by two and an half, and laid edgeways. The length of the spar to be ten feet, being a proper pitch for tiling; and to be cut two inches and a half thick, five at bottom, and three and a half at the top. The lower rooms to be seven feet high, in the clear, under the joists. In the largest sized brick cottages, the roof to be hipped in at the ends, which will save the two peaks of brick-work, and will not require more tiling than would be made use of without it. One great advantage derived from hipping, is, in the building's being better braced together, and more secure from the effect of tempests; for, where the gable-ends are carried up in peaks, to any considerable height, without chimnies to strengthen them, they are not so well fitted to resist an end-wind.

The ceiling should be between the joists, nailing first a few laths at about a foot apart, croſs-ways, and the other laths length-ways over them; otherwise the mortar has nothing to get hold of. This makes leſs expense than ceiling over the joists; and is besides better calculated to retain the mortar, and will afford more space; for the joists being left naked, will be very useful to hang many things to. The ceiling joists upon the top of the chamber need be only five inches by one and a quarter, and may be nailed to the spars-feet, and not pinned. The other scantlings are as follow. The partition studs three inches by two. The lower cills six inches by five. The window-frames three inches by three. Lower door-cases five inches by four. Croſs mantle-pieces for the chimnies eight inches by eight.

In the wooden cottages, the frame-studs are to be six inches by five. The intermediate, or smaller studs, five inches by three. The girt-pieces six inches by five, and the upper cill five inches square.

ESSAY VIII.

On Meteorology, as applicable to Husbandry.

IT is obvious from the effects of the weight and temperature of the air, upon the barometer and thermometer, that the same causes must operate at the same time upon the animal and vegetable kingdoms. If, therefore, the science of meteorology can be rendered subservient to the purposes of the husbandman, so as to enable him to prognosticate the changes of the weather, and the nature of these changes, it appears to me, that the philosopher should direct the farmer's attention to such phænomena in the animal and vegetable kingdoms, as may be found to predict such changes. For it is evident, that whatever the most unexceptionable theory, or even demonstration might effect—in the abstruse, scientific manner of Mr. Kirwan, in his late ingenious eſsay *on the temperature of different latitudes*, or the truly sagacious and indefatigable Mr. de Luc, in in his repeated inquiries into the *modifications of the atmosphere*—it could not be accommodated to the comprehension of a common farmer, except in the way of popular corollaries or inferences. Undoubtedly, most of the physical phænomena of meteorology, properly so called, depend upon the inceſsant decomposition and recomposition of the expansible fluids contained in the atmosphere; yet if the philosopher, capable of accounting for these phænomena, cannot reduce his deductions from them into such language, as is intelligible to a common farmer, their utility must consequently be limited to those, who, perhaps, have least occasion to apply them to the exigencies of common life. If such be the case, it must be the ardent wish of every friend to the real interests of agriculture—an art universally acknowledged of the last importance to man—that philosophers, capable of executing the task with propriety, would condescend to direct the farmer's attention to such obvious phænomena as might enable him to prognosticate the changes of the weather, which more immediately influence his most important operations. That such phænomena as would answer this desirable purpose, are exhibited in the animal and vegetable kingdoms, I flatter myself might be easily discovered by a judicious and attentive observer. And though the information derived from these sources, might not be so extensive, or afford so much time for application, as that deduced from the other, (supposing abilities for such deduction) the easineſs of its application would more than compensate for this deficiency. For these reasons, I am fully persuaded, that the result of accurate observations, made upon the animal and vegetable kingdoms, and occasionally published, till a maſs of well-authenticated information were collected, sufficient to constitute a popular directory, to ascertain the changes of the weather, would be an important acquisition not only to agriculture, properly so called, but to all the most interesting operations of the farmer. From this investigation, I would by no means exclude the use of the barometer, thermometer, hygrometer, or any other instruments calculated to show the changes in the state of the atmosphere; as I have sanguine hopes, that the appearances indicated by them, may be reduced to much greater accuracy and precision, by comparing them with the phænomena of nature, in the manner I am now recommending to the attentive observer, than can be collected from them at present. As to myself, I can truly declare, that with the strictest attention, and some little meteorological knowledge, I have, for many years, examined and registered the indications of these instruments, without being able to make the least useful deduction from any of them, as a farmer, or derive any scientific information from them, excepting the thermometer, as a philosopher. The common farmer, therefore, absolutely wants some easy certain rules to ascertain the changes of the weather, and the nature of these changes; for information in the latter case, it is in vain to consult any mechanical instruments. If then the animal, vegetable, and mineral kingdoms, particularly the two first, exhibit such appearances as indicate a change of weather, and by accurate and repeated observations we be enabled to prognosticate the nature of that change, we shall have a sure criterion of the weather from the vernal to the autumnal equinox, a season of prime importance to the farmer. We know from experience, particularly such of us as are of a delicate, irritable constitution, that changes of the weather affect us very sensibly; and analogy leaves us not the least reason to doubt, but that every beast, bird, and insect, are affected by the same causes, and, if attentively observed, would afford useful information with respect to these changes. Many vegetables too exhibit very curious and significant indications of atmospherical influences, and repeated observations made upon these, corrected and aſsisted by collateral observations made upon the other sources of meteorological information, would, in time, afford such certain and infallible rules for prognosticating the weather, as would not be far short of absolute demonstration. I hope no person will object to the unwarrantable extension I have given to the meaning of the word meteorology; I am conscious that what I am recommending to the attention of the philosophical observers of nature, is not properly the science of meteors, but of their effects; but if it be a more compendious, more popular, and consequently a more useful way of discovering the changes of the weather, the misapplication of a word will not, I hope, be considered as of much importance. When I add, that the *shepherd of Banbury's rules for judging of the weather*, should be examined, corrected, and extended, as an additional and important supplement to this plan, it may, with propriety, be intitled meteorological.

ESSAY IX.

On the Size of Farms.

THE proper size of a farm, is a question upon which theorists have often disputed. In my present inquiry, I shall be regulated by practical principles; and although I am fully convinced, that a farm of a proper extent, suited to the capital and abilities of the poſseſsor, operates as a spur to activity and diligence, yet I am not an advocate for a system that would monopolize the lands of any country, by throwing them into the hands of a few.

An improved system of husbandry, requires that the farm upon which it is to be carried on, should be of some extent, else room is not afforded for the different crops neceſsary to complete a perfect rotation of management. The farmer, who practises husbandry upon judicious principles, should not only have his fields under all sorts of grain, but likewise a sufficient quantity of graſs and winter crops, for carrying on his stock of cattle and sheep through all the different seasons of the year. By laying out land in this style, the economy of a farm is so regulated, that while improvements progreſsively go forward, too much work does not occur at one time, nor occasion for idleneſs at another. This, when the expenses of farm-culture are so extravagant as at present, deserves particular attention; but cannot, in the nature of things, be justly and accurately arranged, where the farm is of small size.

It may be imagined, that the arrangement of farm-labour, and the cultivation of the ground, whatever the size of the farm may be, is but a rule-of-three question; and that the smallneſs of the poſseſsion only reduces the scale upon which improvements are to be carried on. This may in part be true; but will the result of the question be favourable to improvements? Upon 50 acres, labour may not be afforded for half a team; the enclosures would perhaps be a few acres, and the farmer would go to market and buy a single beast, thereby affording opportunity for spending half the year in idleneſs, wasting the ground by a number of fences, and occasioning more expense than the whole profit would repay. These things are the neceſsary consequences of arranging farm management like an arithmetical question, and are great drawbacks upon the profits of farming.

Besides, an improved system of husbandry requires, the farmer should be poſseſsed of an adequate stock, a thing in which small farmers are generally deficient. It is an old proverb, the truth of which I have too often seen exemplified, " that the poor farmer is always a bad one." Allowing he has knowledge, he cannot reduce it to practice, for want of the neceſsary means. The smallneſs of farms, and the precarious situation of the farmer's condition, arising from want of leases, as well as the trammels under which he is generally obliged to work, have, in a great measure, thrown capitals into another line. Unleſs these circumstances are altered, persons of abilities, and poſseſsed of stock, will be induced to despise the profeſsion, and agriculture will not be carried on in its most improved state.

With regard to the question, whether large or small farms are generally best managed? I apprehend very few words will suffice. Who keeps good horses, and feeds them well? Who makes the completest fallow, takes the deepest furrow, and ploughs best? Who has the greatest number of hands, and sufficient strength for catching the proper season, by which the crop upon the best of grounds is often regulated? Who purchases the most manure, and raises the weightiest crops? I believe, in the general, these questions must be answered in favour of the large farmer. If so, it follows that the prevalence of small farms retards improvement.

It is a popular doctrine, that large farms are unfriendly to population, and that they ought to be discouraged. I suspect this doctrine is founded in prejudice, and will not stand the test, if accurately examined. No doubt, if farms are increased in size, the number of farmers is leſsened; this is granted: but with regard to the great scale of population, I am clearly of opinion it is not affected. If a more superior practice is carried on upon a large farm than a small one, this must be accomplished by employing a greater number of hands. What, therefore, is lost in one claſs, is gained in another. Besides, I have often noticed, that upon large farms most married servants are kept, which affords encouragement to the increase of population. Upon a ſmall farm, from 50 to 100 acres, what is the farmer to do? he has not ſufficient buſineſs for employing his attention, and the ſmallneſs of his poſseſsion will not allow him to be idle. He therefore muſt work with his hands, which brings the queſtion preciſely to the ſame iſsue, as if all work was performed by hired ſervants; independent of the arguments adduced, that more work is executed, and more hands employed, upon a large farm, than upon the ſame extent of land divided into ſmall ones.

It has given me ſurpriſe to obſerve many perſons taking it for granted, that by increaſing the ſize of a farm you neceſsarily decreaſe the number of the people; without conſidering that if the management is equal in every reſpect, the population muſt be exactly the ſame, with the exception of one or two farmer's families. They tell you that cottages are pulled down, whereas the large farmer has occaſion for more cottages than the ſmall farmer, as he cannot keep ſo many houſe-ſervants, and is often under the neceſsity of building new houſes, in order that the number of ſervants he keeps may be accommodated. An attentive obſerver will ſmile at the doleful picture exhibited by ſuch alarmiſts, which, to do them justice, are not original ones, being borrowed from former times. In a word, wherever work is carried on, it must be done by employing hands, and wherever work is executed in the most perfect manner, the greatest number of hands must be employed. If the system carried on upon the premises is improved, the population must of course be increased; the one is the cause, the other is the effect; and practice and daily experience justifies the conclusions I have drawn.

ESSAY X.

On Fallowing.

WHETHER summer fallow is neceſsary or unneceſsary? is a question lately agitated; and in a reſpectable work*, an attempt has been made to explode this practice, which has long been considered a most beneficial improvement. The agriculture of Britain is materially interested in the iſsue of this question.

To keep his land clean will always be a principal object with every good farmer; for, if this be neglected, in place of carrying rich crops of corn or graſs, the ground will be exhausted by crops of weeds. Where land is foul, every operation of husbandry must be proportionally non-effective, and even the manures applied, will, in a great measure, be lost.

If the season of the year, and the state of the weather, when the ground is ploughed, preparatory to receiving the seed, be duly considered, it will be found, that at that time, it can neither be properly divided by the action of the plough; nor can root-weeds, or annual weeds, be then extirpated. Hence arises the neceſsity of working it in summer, when the weather is favourable for the purpose of ploughing, and when root-weeds may be dragged to the surface. It is only at that time the full advantages of ploughing are attainable; for summer fallow may, with propriety, be styled ploughing in perfection.

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* The Survey of Norfolk by Mr. Kent.

The neceſsity of summer fallow, depends greatly upon the nature and quality of the soil; as upon some soils a repetition of this practice is seldomer required than upon others.—Wherever the soil is incumbent upon clay, or till; it is more disposed to get foul, than when incumbent upon a dry gravelly bottom; besides, wet soils, from being ploughed in winter, contract a stiffneſs which leſsens the pasture of artificial plants, and prevents them from receiving sufficient nourishment. When land of a dry gravelly quality gets foul, it may easily be cleaned without a plain summer fallow; as crops, such as turnips, &c. may be substituted in its place, which, when drilled at proper intervals, admit of being ploughed as often as neceſsary; whereas wet soils, which are naturally unfit for carrying such crops, must be cleaned and brought into good order by frequent ploughings and harrowings during the ſummer months.

The county of Norfolk generally consists of dry sand, or of rich sandy loam; and, agreeably to the above principles, summer fallow may, in that district, be considered as unneceſsary. If Mr. Kent had confined his strictures to the husbandry of Norfolk, no objection could reasonably have been urged against them; but when he condemns summer fallow altogether, he strikes at the agriculture of Britain in a most material point.

The substance of Mr. Kent's arguments against fallow, may be comprised under four heads:

1*st*, Nature does not require any pause or rest, and the earth was evidently designed to yield a regular uninterrupted produce.

2*dly*, As the productive quality of the earth never ceases, if corn is not sown, weeds will be produced; therefore it is our buſineſs to expel the unproductive plant, and to introduce others that are beneficial.

3dly, That the idea of leaving land to rest is ridiculous; for by keeping it clean, and by a judicious intermixture of crops, it may be managed like a garden, and sown from one generation to another.

4thly, That the fallows in England exhibit nothing but a conflict betwixt the farmer and his weeds, in which the latter generally prevail, for they are only half stiffled, and never effectually killed.

The most of these arguments may be granted, and yet the utility, nay, the neceſſity of summer fallow be consistently maintained.

It is already acknowledged, that it is only upon wet soils, or in other words, upon land unfit for the turnip husbandry, a plain summer fallow is neceſsary; and this, we suppose, includes one half of the island. The utility of summer fallow upon such soils is not contended for, because nature requires a pause or rest, to invigorate her to carry freſh crops; but solely because it is impoſsible to keep them clean without this auxiliary aſsistance. To speak of following nature in farming is mere sound; for if we were to imitate nature, we would not cultivate land at all. Nature is often improved by art, and fallowing is the means employed for removing a host of enemies, which prevent her from being fertile and productive.

As a field filled with root-weeds, must be in a state of greater exhaustion, than if it carried a heavy crop of corn, so the productive quality of the earth must neceſsarily decrease in proportion to the quantity of weeds it brings forth. But because corn is not sown, it does not follow that weeds of any kind should be suffered to grow. The object of allowing the ground to remain a year under fallow, is to afford time and opportunity for expelling the unproductive plant, and to prepare it for the reception of others, which are beneficial.

The most judicious intermixture of crops upon clay soils, will not preclude the neceſsity of summer fallow, although it will go a great way to prevent a frequent repetition of it. An eight-course shift, such as fallow, wheat, beans drilled and horse-hoed, barley, graſs seeds, oats, beans, and wheat, is as much as can be recommended; and it is only upon rich clay, or deep loam, where such an extensive rotation is admiſsible. A shift of this kind, when dung is applied twice in the course of it, will pay the farmer more handsomely than the most judicious intermixture of crops, where fallowing is neglected.

Again, no rules drawn from garden-practice, will apply to operations carried on in the field; the soils are generally very different, and any comparison that can be made, must be with those rich sandy soils, upon which we have allowed fallowing to be unnecefsary. The crops in gardens are reaped at so many different times, and often so early in the season, that opportunity is alway gained for working the ground in the completest manner; while the immense difference betwixt working with the plough and the spade, renders every comparison ridiculous.

A fallow field which exhibits a conflict betwixt the farmer and his weeds, does not deserve that appellation; for the intention of the fallow is to extirpate these weeds. I am inclined to think, that the shocking situation of many English fallows, may be attributed to the feeding, and folding them with sheep. The farmer, from being obliged by the conditions of his lease, or the rules of common-field management, to fallow every third or fourth year, is tempted to draw something from them when in this unproductive state; and, to gratify his avarice in the first instance, sacrifices the good husbandry which it is his ultimate interest to practice. A well-managed fallow should be wrought as early in the season as poſsible, and continually turned over when the least particle of quick-graſs appears. It is no argument against the utility of fallows, that they are often managed in a different way; this goes only against the impropriety of the management, but does not militate against the practice itself.

The neceſsity of summer fallow turns upon this single point: Can wet lands be advantageously employed in raising turnips or cabbages? a question which the *practical farmer*, who is sufficiently acquainted with the nature of such soils, and the immense labour required to bring them into proper tilth, will have no difficulty to answer in the negative.

It is not disputed but that turnips and cabbages will grow upon these soils; but the question is, whether the extraordinary labour they require, and the damage sustained by the ground, during the consumption or carrying off the crop, will not exceed the value of the produce?

Nothing that is said in defence of fallow, is meant in vindication of the absurd system of taking only two crops to one fallow, as practised upon many English common fields. It is only meant to show that clay soils, and every soil incumbent upon a wet bottom, cannot be kept clean, without the aſsistance of this radical and antient practice. How often it should be used, must in a great measure be left to the discretion of the farmer, who will repeat it when neceſsary, if he knows his own interest.

As many different opinions prevail relative to the manner in which a fallow should be conducted, I beg leave to give my sentiments upon that head.

Upon all clay soils (and upon such only, we understand a complete summer fallow to be neceſsary) the first ploughing ought to be given during the winter months, or as early in the spring as poſsible, which promotes the rotting of the sward and stubble. This should be done by gathering up the ridge, which both lays the ground dry, and rips up the furrows. As soon as seed-time is over, the ridge should be cloven down, preparatory to croſs ploughing; and, after laying a proper time, should be harrowed and rolled repeatedly, and every particle of quick-graſs that the harrows have brought above should be carefully picked off with the hand. It is then proper to ridge or gather it up immediately, which both lays the land in proper condition for meeting bad weather, and opens up any fast land that may have been miſsed in the furrows when the croſs ploughing was given. After this, harrow, roll, and gather the root-weeds again; and continue so doing till the field is perfectly clean.

Frequent turning over the ground, although absolutely neceſsary while the proceſs of fallowing is going on, can never eradicate couch-graſs, or other root-weeds. In all clay soils, the ground turns up in lumps, which the severest drought will not penetrate, or at least not so far as to kill the plant contained in the heart of them. When the land is ploughed again, these lumps or clods are simply turned over, and no more; and the action of the plough serves in no shape to reduce them, or at least in a very imperceptible manner. If ever there was a season for making good fallow by ploughing, it was that of 1793; there was hardly a drop of rain the whole summer; the drought was exceſsive, and attended with an almost continued sun-shine. Notwithstanding all these advantages, the fallows which were not properly reduced in the beginning of the season, took on a growth as soon as moisture came, about the beginning of harvest. Even when they were completely harrowed and rolled, it was found difficult to extirpate couch, as the dryneſs of the ground did not allow it to part so well from the clod as in seasons more moist.

If this was the case in such a dry season as 1793, what would the consequences be if the fallows were at all times to be wrought with the plough, without attempting to drag the roots to the surface by the operation of harrowing? In wet weather, the land might appear black above for a few days; but the enemy, being still in the house, would soon make his appearance. By carefully gathering the root-weeds, when the land is reduced, which on many soils is only practicable after the roller is used, an enemy is converted into a friend; for if the stuff so gathered is accumulated into a heap, frequently turned over, till it rots, and mixed with lime, a most excellent compost is produced.

There is very little danger that clay land will ever be too much reduced by the different harrowings and rollings proposed to be given, as the last furrow, if taken deep, will raiſe a mould sufficiently rough for covering the seed, and for protecting the wheat during the winter. Nothing but frost will reduce and mellow such soils perfectly; and I have seen the neceſsity of leaving fields of this description to be finished in the spring, from the absolute impoſsibility of eradicating or killing the couch, till reinforced by this powerful auxiliary.

I shall just mention another argument in favour of gathering root-weeds;—that in no other way can the purpose for which fallow is intended, be so cheaply attained. Every furrow that is given, will at least stand the farmer in 7s. per acre; and if hand gathering will save one single ploughing, its expense is amply repaid; while at the same time I contend, that more root-weeds are taken off by one gathering, than can be destroyed by a couple of ploughings, allowing the season to be ever so favourable.

Upon the whole I am decidedly of opinion, that to give up summer fallows, or what is commonly called naked summer fallows, an argillaceous soil would prove ruinous to the husbandry of Great Britain, and that in the right management of this radical operation, every farmer ought to feel himself deeply interested. Those who poſseſs such soils, know by experience the difficulty of keeping them clean, even with the aſsistance of summer fallow. They are so often ploughed wet, from neceſsity, that a sourneſs and adhesion are contracted, which cannot be corrected without exposing the land to the hot summer sun, and reducing it by frequent ploughings and harrowings. I repeat again, that no crop can there be substituted in place of fallow; for turnips are destruction itself. Drilled beans, will do well as an aſsistant; but however much this crop may tend to *keep* land clean, that is already in good order, I apprehend, from the neceſsity of sowing them early, they will never answer as a substitute for one of the most radical of all improvements,—a clean summer fallow.

In many corn districts, fallows perhaps prevail to a much greater extent than neceſsary; and occasion a great drawback upon the farmer's profits. If good land be fallowed properly, can it ever be supposed neceſsary to repeat it after carrying only wheat and beans, as is customary in several English Counties? When this practice is too often repeated, it loses much of its effects, the superior advantages arising from a first fallow being well known to all farmers; and while I condemn the system that would throw out this beneficial practice altogether, I am equally averse to an unneceſsary repetition of it.

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AY XI.

Graſses

our meadow and pasture ered infinitely more valuable present, by the introduction of st graſses, is an opinion which evailed among many of the more agriculturists of the present age. some of these have endeavoured to he husbandman to collect and cultivate this sort, by writings fraught with the reasoning; others have attempted to him by the offers of well-directed miums. But, hitherto, neither the writings the one, however convincing, nor the emiums of the other, however alluring, have been productive of the desired effect; ay-graſs still continues to be the only graſs whose seeds can be purchased for the purpose of laying down meadow and pasture land; and how inadequate that graſs is for such a purpose, is known to every intelligent farmer. Why indeed the *Lolium perenne* (ray-graſs) should originally have been made use of, in preference to all the other graſses, cannot, perhaps, be satisfactorily accounted for; most probably it owes its introduction to accident, or to its being a common graſs whose seeds were easily collected, rather than to its being preferred from an investigation of its merits compared with the others; however this may be, there appears to be no reason for excluding the others; for it would appear exceedingly improbable that of upwards of a hundred graſses growing wild in this country, the Author of Nature should have created one only as suitable to be cultivated for pasturage or fodder.

Taking it for granted then, that there are other graſses, superior, in many respects, to the ray-graſs, this question naturally arises:—How comes it that they have not found their way into general use? To this it may be answered; improvements in any science, but more especially in agriculture, are slow in their advances; and, perhaps, no claſs of men adheres more pertinaciously to old practices than the farmer.

The difficulty of distinguishing the graſses one from another, has, no doubt, proved one grand obstacle; many of these plants are so much alike, that the most discerning botanist is often at a loſs to know some of them apart; if so, how easily may the husbandman be deterred from the arduous task?

There is another cause which may have operated against their introduction: graſses, as well as other plants, have been frequently recommended, from a partial and limited obſervation of them, by perſons who neither knew them well as botanists or agriculturists, or who have recommended them, merely to gain by the credulity of the public.

But, perhaps, the chief reason has been, that persons who might be expected to make the improvements, have not had the means fairly put into their hands of making the experiment. Whether the method we have adopted on this occasion, may be more succeſsful than those of our predeceſsors, must be determined by the event. From the numerous applications made to me, by a variety of gentlemen, for graſs-seeds, it has appeared incumbent on me to do something which might gratify them, and render the public an eſsential service; I wish, at least, to put it into their power to decide on a matter which has been long agitated, and from which I am far from being the only one that entertains the most sanguine hopes of its proving a great national advantage.

The graſses recommended will, I am certain, do all that *our natural graſses* can do: they are six of those which constitute the bulk of our best pastures; most of them are early, all of them are productive, and they are adapted to such soils and situations as are proper for meadows and pastures.

But let no one expect them to perform wonders; for, after all, they are but graſses, and, as such, are liable to produce great or small crops, according to particular seasons, or to the fertility or barrenneſs of the soil on which they are sown.

I. ANTHOXANTHUM ODORATUM. *Sweet-Scented Vernal-Graſs.*

Next to the *Cynosurus Cæruleus*, or *Blue Dog's-Tail Graſs*, this, of all our English graſses, comes first into bloſsom; it is therefore valuable as an early graſs; it is valuable also for for its readineſs to grow in all kinds of soil and situation, being found in bogs, in woods, (especially such as are of low growth, or have had the underwood cut down) in rich meadows, and in dry pastures; in point of crop, it is not so productive as some, yet more so than others; cattle appear to be fond of it, and it is well known to be the only English graſs which is odoriferous; the agreeable scent of new-made hay arises entirely from this graſs; hence its name of *odoratum*, or sweet-scented: the green leaves, when bruised, readily impart this perfume to the fingers, by which means the foliage may at all times be known; and persons not deeply skilled in botany, may distinguish it when in bloſsom, by its having only two threads or stamina to each flower.

Of the several graſses here recommended, it is the least productive in point of seed.

II. ALOPECURUS PRATENSIS. *Meadow Fox-Tail Graſs.*

This produces its spike almost, and in some situations to the full, as early as the *An-*

thoxanthum: hence it is equally valuable as an early graſs; and as it is much larger, and quicker in its growth, it is consequently much more productive; it shoots very rapidly after mowing, producing a very plentiful aftermath; and where land is rich, and two crops are not thought too much for it to bear, of all our English graſses this appears to be the best adapted to such a purpose, and ought to form a principal part of the crop: its foliage may, perhaps, appear coarse to some, but it ſhould be remembered, that no English graſs can be productive that is not in ſome degree coarse; but if mown early, just as it comes into bloom, though the leaves are large, the hay will not be coarse; in general, the great advantage arising from the earlineſs of this and the preceding graſs, is entirely loſt at a distance from London, where hay-making commences late, and where the husbandman seems to wait for a crop of general indiscriminate herbage, rather than of graſs.

The *Meadow Fox-Tail* is more confined as to its place of growth; growing naturally in a moist soil only: hence it is best adapted to improve very wet ground that may be drained of its superfluous moisture, or to form or meliorate meadows that have a moist bottom, and are not apt to be burnt up in dry summers.

Its seeds are easily collected, but a great number of them, we believe, at least one third, are yearly destroyed by a very minute orange-coloured larva or maggot, which feeds on the embryo of the seed, and produces a very small musca or fly, probably the *Musca Frit* of Linnæus.

This graſs is distinguished, in some degree, by the largeneſs of its foliage, and by its producing a soft spike, on a long stalk, early in May. The *Meadow Cat's-Tail Graſs* produces a spike somewhat similar, but rougher to the touch, and much later in the summer.

III. POA PRATENSIS. *Smooth-Stalked Meadow-Graſs.*

The foliage of this graſs begins to shoot, and to aſsume a beautiful verdure very early in the spring, but its flowering stems are not produced so soon, by at least a week, as those of the *Alopecurus:* this trifling difference, however, in point of earlineſs of flowering, does not prevent it from ranking very properly with the two preceding; and, where early graſsy pasturage is a desideratum, we are of opinion it cannot better be obtained than by a combination of these three; if crop be at the same time an object, the *Meadow Fox-Tail Graſs* should predominate.

This graſs rather affects a dry than a moist situation, and hence it keeps its verdure in long-continued dry weather better than most others, but it will thrive in either; will grow on the top of a dry wall, but grow much more luxuriantly in a rich meadow: it is to be observed, however, that it has a root which creeps like the *Couch-Graſs*, and is almost as difficult to extirpate; it ought, therefore, to be cautiously introduced where the pasturage is not intended to be permanent.

Of the trifling improvements which we flatter ourselves to have occasionally made in some of the specific characters of the English plants, none have given us more satisfaction than those which relate to this species and the *Poa Trivialis*, two graſses so very similar, as scarcely to be distinguished, even by the most discerning eye, at a little distance, and very obſcurely characteriſed by Linnæus, but which, by attending to two characters only in each graſs, may now, in a moment, be distinguiſhed with the utmost facility and certainty.

The *Poa Pratenſis* has a ſmooth stalk, the *Trivialis* a rough one, perceptible when drawn betwixt the thumb and finger, and which ariſes from little ſharp points, viſible when the ſheath of the leaf which covers the stalk is magnified: the *Trivialis* has a long pointed membrane at the baſe of the leaf: the *Pratenſis* a ſhort blunt one. Theſe graſses differ ſpecifically in a variety of other particulars, not neceſsary here to dwell on; and which ſuch as wiſh to be more particularly informed of, may conſult the *Flora Londinenſis.*

IV. POA TRIVIALIS. *Rough-Stalked Meadow-Graſs.*

Similar as this graſs and the preceding are in their appearance, particularly in the mode of flowering, they differ very eſsentially in their qualities. While the *Smooth-Stalked Meadow Graſs* is found chiefly in dry paſtures, the *Rough-Stalked* principally occurs in moiſt meadows, or on the edges of wet ditches; it loves moisture, and a situation that is rather shady; hence, though there are few graſses more productive, or better adapted for hay or pasturage, it is a tender graſs, and liable to be injured by severe cold, or exceſsive drought. In very wet ground near the Thames, we have observed it grow very tall; while in poor land we have, on the contrary, seen it altogether as diminutive. It is, perhaps, no small recommendation to it, that it is a principal graſs in that uncommonly productive meadow near Salisbury, mentioned by Stillingfleet, and more particularly described in the Memoirs of the Bath Agricultural Society, *vol.* 1. *p.* 94.

The account given of the extraordinary fertility of this meadow, excited our curiosity, and induced us to request a gentleman residing near the spot, to favour us with six small turfs, cut up in different parts of the said meadow, and which being planted in our garden, Lambeth-Marsh, produced as follows:

TURF 1. Poa Trivialis,
Ranunculus acris,
Triticum repens,
Agrostis alba.

TURF 2. Poa Trivialis,
Alopecurus pratenſis,
Triticum repens.

TURF 3. Poa Trivialis,
Agrostis alba.

TURF 4. Poa Trivialis,
Triticum repens,
Peucedanum Silaus.

TURF 5. Poa Trivialis,
Alopecurus pratenſis,
Agrostis alba,
Avena elatior,
Triticum repens.

This experiment proves, in a great degree at least, what we long before ſuſpected, that the extraordinary fertility of this meadow aroſe not from any new graſs peculiar to it, but from ſeveral unuſual circumſtances concurring, and favouring, in an uncommon degree, the growth of certain well-known graſses, eſpecially the *Poa Trivialis* and *Agroſtis alba.*

We may remark that the ſeeds of the *Poa Trivialis* and *Poa Pratenſis*; but more eſpe-

r, are apt to be en-
h other, as if cob-
l with them.

ENSIS. *Meadow Fescue-Graſs.*

eral graſses here recommended,
the nearest, in its appearance, to
-Graſs, to which, however, it seems to
n many respects, to be greatly superior,
least, for the purpose of forming or improving meadows; it is larger, and more productive of foliage; it is strictly perennial; it is very hardy, and will thrive not only in very wet, but also in dry ground: we have found it growing in all situations, from the sand-pits at Charlton, to the osier-grounds at Batterſea; and it abounds in the very best meadows about London; in short, we know of no graſs more likely to supply the deficiencies complained of in Ray-Graſs; and yet it has not, that we know of, been particularly recommended.—One quality it has, which bids fair to introduce it quickly into more general use; it produces more seeds than any of the others, which are easily gathered, and readily grow. In one respect, it is inferior to the three first graſses;

it does not produce its flowering stems earlier than about the middle of June, a fortnight or three weeks later than the *Meadow Fox-Tail Graſs;* yet it cannot be considered as a late graſs, as most of the Agrostis tribe, and the *Meadow Cat's-Tail Graſs,* flower at least three weeks later. It must be carefully distinguished from the *Festuca Elatior,* or *Tall Fescue-Graſs,* which is a very similar but much coarser graſs.

VI. CYNOSURUS CRISTATUS. *Crested Dog's-Tail Graſs.*

It is chiefly from the great character which this graſs bears as a favourite and wholesome food for sheep, and from its being found in our soundest and best pastures, that it is here recommended. It grows naturally in dry situations, and will not thrive in meadows that are very wet: it flowers about the same time as the *Meadow Fescue-Graſs,* and is not very productive of foliage. As its flowering stems are always left untouched by cattle; its seeds may easily be collected, where the pasturage is fed, not mown.

Of the above six graſses, it will appear that

Tail, and Rough-Stalked
fittest for moist land.
veet-Scented Vernal,
moist or moderately
Meadow-Graſs, and
, are fittest for dry pasture.

Order of their Flowering.

1. Sweet-Scented Vernal.
2. Meadow Fox-Tail.
3. Smooth-Stalked Meadow.
4. Rough-Stalked Meadow.
5. Meadow Fescue.
6. Crested Dog's-Tail.

We could easily add many more graſses to this list, and those too which, perhaps, may be highly deserving of it; but we have our doubts, whether by recommending more, we might not increase the difficulty of introducing graſs seeds without any adequate advantage.

We shall, however, just take the liberty to mention such other English graſses, as appear to us, from long and repeated observation, deserving of further notice, and these are

Avena Elatior, Tall Oat Graſs: common in wet meadows, and by the sides of hedges, early, and very productive, but coarse.

Avena Flavescens, Yellow Oat-Graſs: affects a dry soil, is early, and productive; bids fair to make a good sheep-pasture.

Avena Pubescens, Rough Oat-Graſs: soil and situation nearly similar to that of the *Meadow Fescue*, hardy, early, and productive.

Bromus Erectus, Upright Brome-Graſs: peculiar to chalky soils, early and productive; promises to be a good graſs for chalky lands, and thrives indeed very well on others.

Cynosurus Cæruleus, Blue Dog's-Tail Graſs: earliest of all the graſses; grows naturally on the tops of the highest lime-stone rocks in the northern parts of Great Britain; not very productive, yet may, perhaps, answer in certain situations, especially as a graſs for sheep; bears the drought of summer remarkably well; at all events, seems more likely to answer than the *Sheep's Fescue Graſs*, on which such encomiums have, most unjustly, been lavished.

Dactylis Glomeratus, Rough Cock's-Foot

Graſs: a rough coarse graſs, but extremely hardy and productive; soil and situation the same as the *Meadow Fescue.*

Festuca Elatior, Tall Fescue Graſs: tall and coarse, but very productive; affects wet situations.

Festuca Duriuscula, Hard Fescue Graſs: affects such situations as the *Smooth-Stalked Meadow Graſs;* is early, and tolerably productive; its foliage is fine, and of a beautiful green; hence, we have sometimes thought it was, of all others, the fittest for a graſs-plat or bowling-green; but we have found, that though it thrives very much when first sown or planted, it is apt to become thin, and die away, after awhile.

Phleum Pratense, Meadow Cat's-Tail Graſs: affects wet situations, is very productive, but coarse and late.

Directions for Sowing Graſs Seeds in small quantities.

If a piece of ground can be had, that is neither very moist nor very dry, it will answer for several sorts of seeds; they may then be sown on one spot: but if such a piece cannot be obtained, they must be sown on separate spots, according to their respective qualities, no matter whether in a garden, a nursery, or a field, provided it be well secured and clean. Dig up the ground, level, and rake it, then sow each kind of seed thinly in a separate row, each row about a foot apart, and cover them over lightly with the earth; the latter end of August, or beginning of September will be the most proper time for this busineſs. If the weather be not uncommonly dry, the seeds will quickly vegetate, and the only attention they will require will be to be carefully weeded: in about a fortnight from their coming up, such of the plants as grow thickly together may be thinned, and those which are taken up transplanted, so as to make more rows of the same graſs.

If the winter should be very severe, though natives, as seedlings, they may receive injury, therefore it will not be amiſs to protect them with mats, fern, or by some other contrivance.

Advantage should be taken of the first dry weather in the spring, to roll or tread them down, in order to faſten their roots in the earth, which the froſt generally looſens: care muſt ſtill be taken to keep them perfectly clear from weeds. As the ſpring advances, many of them will throw up their flowering ſtems, and ſome of them will continue to do ſo all the ſummer. As the ſeed in each ſpike or pannicle ripens, it muſt be very carefully gathered, and ſown in the autumn, at which time the roots of the original plants, which will now bear ſeparating, ſhould be divided and tranſplanted, ſo as to form more rows; the roots of the *Smooth-Stalked Meadow Graſs*, in particular, creeping like *Couch Graſs*, may readily be increaſed in this way; and thus, by degrees, a large plantation of theſe graſses may be formed, and much ſeed collected.

While the ſeeds are thus increaſing, the piece or pieces of ground which are intended to be laid down, ſhould be got in order. If very foul, perhaps, the beſt practice (if paſture land) will be to pare off the ſward and burn it on the ground; or, if this ſhould not be thought adviſable, it will be proper to plough up the ground and harrow it repeatedly, burning the roots of *Couch Graſs*, and other noxious plants, till the ground is become tolerably clean; to render it perfectly so, some cleansing crop, as potatoes or turnips, should be planted or sown.

By this means, the ground we propose laying down will be got into excellent order without much loſs; and being now ready to form into a meadow or pasture, should be sown broadcast, with the following composition;

Meadow Fox-Tail, one pint.
Meadow Fescue, ditto.
Smooth-Stalked Meadow, half a pint.
Rough-Stalked Meadow, ditto.
Crested Dog's-Tail, a quarter of a pint.
Sweet-Scented Vernal, ditto.
Dutch Clover (Trifolium Repens) half a pint.
Wild Red Clover (Trifolium Pratense,) or, in its stead, *Broad Clover of the Shops*, ditto.
For wet land, the *Crested Dog's-Tail* and *Smooth-Stalked Meadow*, may be omitted, especially the former.

Such a composition as this, sown in the proportion of about three bushels to an acre, on a suitable soil, in a favourable situation, will, I am bold to aſsert, form, in two years, a most excellent meadow; and as all the plants sown are strong hardy perennials, they will not easily suffer their places to be usurped by any noxious plants, which, by manure or other means, in spite of all our endeavours, will be apt to insinuate themselves; if they should, they must be carefully extirpated, for such a meadow is deserving of the greatest attention; but if that attention cannot be bestowed on it, and in proceſs of time weeds should predominate over the crop originally sown, the whole should be ploughed up, and fresh sown with the same seeds, or with a better composition, if such should be discovered; for I have no doubt but, at some future time, it will be as common to sow a meadow with a composition somewhat like this, as it now is to sow a field of wheat or barley.

ESSAY XII.

On Manures.

THE term manure, is applied indiscriminately to all substances, which are known from experience, either to enrich the different soils, or contribute by any other means to render them more favourable to vegetation.

Though little doubt can be entertained of the utility and neceſsity of such substances, yet the progreſs hitherto made, in ascertaining the mode in which they ought to be applied, the quantity that should be made use of, or the soils for which they are respectively best adapted, has not yet reached that perfection or certainty that could be wished for.

The most superficial observation will serve to convince every intelligent person, that in an agricultural point of view, the subject of manures is of the first magnitude. To correct what is hurtful to vegetation in the different soils, and to restore what is lost by exhausting crops, are operations in agriculture, which may be compared to the curing of diseases in the animal body, or supplying the waste occasioned by labour, or the ordinary evacuations of nature.

The utility of manuring has, however, been questioned in some instances, paricularly by *Tull* and his disciples, who assert that *tillage alone*, frequently and judiciously applied, will produce every effect that can be expected from that practice.

That tillage is essential to the succeſs of Agricultural operations, is a point in which all good husbandmen are agreed; but that by tillage alone, the earth should be made to produce a succeſsion of valuable crops of grain or vegetables, is a doctrine, which, fortunately for the advancement of agriculture, has met with very few converts. By such management, poor lands would never become productive, and the richest soils would soon be exhausted.

Another opinion has been held forth to the public, that when land has once been put into good heart, it may be preserved in a state of constant fertility, merely by a proper *rotation of crops*, without any foreign manure.

In some particular spots, where the soil is uncommonly rich, and has been long undisturbed by the plough, and when great quantities of animal and vegetable matter have been accumulating for ages, this may, for a considerable space of time, be the case.

But if the advocates for such a system assert that *any land*, when once put into good order, will continue to pour forth an endleſs succession of valuable crops, by means of judicious rotations alone, without any manure being made use of, we pronounce the idea, with but very few exceptions, impossible.

Indeed it might as well be supposed, that any animal, after having made a full meal, would continue to live, and perform every kind of labour, without any farther supply of food. The contrary certainly is the case, both with regard to animals and vegetables; for if the nourishment supplied is leſs than the waste, the animal will die, and the soil become barren.

But it is unneceſsary to extend our observations upon this subject farther; for a good farmer who wishes to avail himself of every advantage which experience points out, will, to a certain degree, adopt 1. *the tillage recommended of Tull*, for the purpose of pulverizing the soil and extirpating the weeds with which it may be infeſted. 2. *A regular rotation of crops*, in order that the various sorts of earth, may, in their turn, according as they are calculated for different plants, become productive: and 3. *A sufficient quantity of Manure*, not only to prevent the soil from being exhausted, but, if poſsible, annually to make some addition to its former sources of fertility.

For the purpose of bringing a subject of such acknowledged importance as agriculture, to a higher degree of perfection than it at present poſseſses, a thorough investigation of every branch of it is neceſsary. It is, however, to be regretted, that the foundation of the whole, namely, the principles upon which fertility and vegetation depend, are still but imperfectly understood. Even the little knowledge of these matters which we are at present in poſseſsion of, has hitherto been confined to the closets of the learned, and seldom been deemed a neceſsary part of education for those whose prospects and succeſs in life depend so materially upon a judicious and scientific system of husbandry.

In the article of manures especially, this knowledge would be peculiarly useful; for by it the intelligent farmer would be enabled to examine and ascertain the distinguishing properties of the articles he makes use of; to collect, prepare, and employ them to the greatest advantage; and to accommodate them to the soil for which they are respectively the best adapted; and thus by having it in his power to combine the cause and the effect, he would have the means of calculating, with much more certainty than it is poſsible for him otherwise to do, upon the succeſs of all his operations.

Having premised these general observations, we shall now proceed to state the various sorts of manures made use of in these kingdoms; and after briefly considering the advantage of combining two or more of them together into one compost, shall then add some general remarks upon the mode of applying them. Authors have attempted to divide manures into various claſses, as into simple and compound, natural and artificial, nutritious and stimulating, or as they are derived from the animal, vegetable, or mineral kingdom; but unleſs philosophers were more agreed, with respect to the principles upon which they respectively act, every attempt at claſsification must be liable to considerable objections, and therefore cannot be attempted with advantage on the present occasion.

Every farmer of experience knows, that certain compounds, formed between the different kinds of manures and soils, have a much greater effect in promoting vegetation, than any of these taken separately. But though this circumstance is familiar to most of them, they have hitherto made little progreſs in ascertaining the manner in which composts operate, or the principles upon which their operation depends.

In analyzing the different soils and manures, we learn, that some of them contain more animal or vegetable matter, than they do salts or earth; and *vice versa*. From this disproportion of principles, such soils and manures are leſs productive than they would otherwise be, if their useful qualities were more equally balanced By compounding or mixing the two together, that end is attained.

Some farmers object to composts on account of the expense, and affirm that every addition of soil, or other substances, made to a dunghill, serves only to increase its bulk, and the expense, without adding any thing to its real value; and that the dung itself is a much better manure, upon all soils, than it can poſsibly be made by any addition.

That the dung of animals is a most valuable article, is beyond all doubt, but it certainly is not equally useful in all soils and situations. It is much better calculated for what are called active, than for inactive soils. On limestone, chalk, &c. &c. it meets with abundance of active materials, which compensate for the want of them in itself. But upon *clays*, *deep loams*, &c. &c. it operates best in conjunction with lime, or some other stimulating substance *.

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* When dung is intended for a compost, no attempt ſhould be made to add any large quantity of lime or earth, till it is properly ſermented; as every addition of that kind will be ſound to check ſermentation, and diminish the value of the compound. The lime and earth should be added, after the fermentation is finished, and the whole carefully mixed and laid up together. A few days after this is done, a second fermentation will come on, and, if the mixture has been properly turned over and thoroughly incorporated, in a month or six weeks afterwards it will be fit ſor use.

When earth is added to such a compost, care should be taken to regulate the quantity in such a manner, as to prevent it from preſsing the dunghill too hard; for, in every instance where this happens, the air will be excluded, so much as to prevent a second fermentation from coming on; and the compost, in that case, will neither incorporate so well, nor be so valuable.

Next to the application of the various sorts of manures, the fertility of the earth depends upon the predominant qualities of the soil; every different kind of which being made up of the same principles, but differently proportioned. In cases where there is a deficiency of any of these, the fault may be rectified by the application of another soil, containing the ingredients that are wanted. Thus, where clay predominates, the addition of sand, is often sufficient to insure fertility, and, where sand prevails, the addition of clay or chalk answers the same purpose. Gravelly soil enriches moſs, and moſs improves gravel. Indeed, until the soil acquire a due proportion of the various ingredients that are neceſsary to insure fertility, the husbandman is particularly called upon to search every where, in the neighbourhood of his fields, for such substances as are likely to accomplish this desirable purpose.

We wish this circumstance to be particularly attended to, as there is abundant reason to believe, that every field has in its neighbourhood some substance, which if properly applied, would give it fresh powers of production. To discover this, not only the surface, but the different sub-soils should be carefully examined, and it is more than probable that some useful article will be found, which if mixed either with the dung of the farm, or applied by itself, will render the soil more fertile.

This mixture of soils answers many very important purposes in agriculture. Stiff soils, which water can hardly penetrate, are by a proper mixture of light earth, sand, or other incoherent substances, opened and subdivided, so as to admit freely a quantity of moisture and other nutritive matters, sufficient for the nourishment of plants*.

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* The following is a striking instance of the benefit resulting from a mixture of soils. Mr. Elkington had on his farm of Princethorp, some fields of strong clay, which

Light soils again, by being incorporated with clay, are thereby rendered more retentive of moisture: by this mixture also the roots of vegetables are at full liberty to spread themselves in all directions, not only in search of their natural food, but also to acquire an establishment in the soil, sufficient to support the trunk and branches of the plant. For it is found, that no vegetable can arrive at perfection, if the roots are prevented from spreading themselves out at pleasure, and, at the same time, taking a sufficient hold of the earth; neither of which can be the case in very stiff or very loose soils.

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he could not plough in a wet season, nor could wheat be always sown in it at the proper time. He was sometimes obliged to employ 6 horses to plough it, and 7 men to level it, by cutting the heaps with three-pronged forks, as spades could not be made use of on account of their sticking. But by carrying a great quantity of sandy soil, (120 loads per acre,) and adding afterwards one coat of marl, the quality of the land became so changed, that 3 horses can plough it, that no men are necefsary for levelling it, and that, in the wettest season, wheat can be sown. The expense of digging and carriage, may be calculated at 18s. per 50 load, which is equal to about 2l. per 120 load. Suppose that the marl cost 1l. per acre, the whole cannot be called a great expense, for so durable and permanent an improvement, which adds to the staple value of the soil, instead of being a mere temporary advantage.

Manure is usually applied in three different ways. The first, and most common, is that of ploughing it in and mixing it with the whole soil. The second, is that of laying it carefully into drills, and sowing the crop upon it. And the third, is that of spreading or scattering it upon young crops, and either harrowing it in, or allowing it to remain upon the surface.

1. *Mixing with the Soil.*

As yet, this is by far the most general mode of application; and where manure can be had in great quantities, it is naturally adopted, the other modes being infinitely more troublesome. It is also the best system where it is neceſsary to enrich a field for a succeſsion of exhausting crops. But it is questionable whether it is the best means to make the most of the manure collected; as some of the most valuable parts of the manure may be ploughed deeper than the roots of many vegetables go, and in some cases, may be entirely washed into the earth and lost.

2. *Manuring in Drills.*

This mode is but partially used, and only for particular crops, as potatoes, turnips, and the like; when the advantage derived from the practice are so much extolled, though not decisively ascertained, it is a matter of surprise that it has not been extended to other descriptions of drill crops. The plant sown upon the manure in this manner, has the chance of receiving the whole benefit of that manure in all the stages of its growth; and if the land is afterwards ploughed croſs-ways, and well harrowed, what remains of its strength and substance is incorporated with the soil. The crops of turnips and potatoes produced by following this plan, on very indifferent soils, and with a small quantity of manure, it is aſserted by the friends of this system, will sometimes equal what a rich soil, with a great quantity of manure will yield.

3. *Top-dreſsing.*

Top-dreſsings are principally confined to particular substances, such as *soot, rape-cake, pigeons' dung, peat-ashes,* &c.; the beneficial effects of which, when applied in this way, are well known, and having been found to answer so well, particularly with crops which tiller, as wheat and barley, it is a matter entitled to the most serious investigation, whether their succeſs has not risen as much from the manner in which they are applied, as from their own eſsential qualities; and as this is a part of the subject which has hitherto been leſs considered than it deserves, it requires to be more fully illustrated.

Any one may ascertain by an easy experiment, that nearly the whole of the useful principles contained in well-fermented dung, may be extracted by repeated washings. When a considerable quantity of any manure, therefore, is laid upon land, and ploughed in, or mixed with the whole soil, a great proportion of its richest parts will be carried down by the rains, and by that means will not only be lost to the present crop, but, if the sub-soil is of a loose and porous nature, will very soon escape beneath the reach of the plough.

Were a contrary system adopted, were stable-dung and all enriching manures mixed with lime or other active substances into the form of a compost, and in that shape employed either as a top-dreſsing, or very near the surface, a much leſs quantity than is usually applied might probably be found sufficient.

By laying manures upon or near the surface, they would sink, by slow degrees; their beneficial effects would be exerted upon the plants in their paſsage downwards, and very little, if any, of them would penetrate deeper than they could be useful.

It is highly probable, therefore, though not yet fully ascertained by experiments, that a much leſs quantity than what is usually ploughed in, if applied as a top-dreſsing, would produce effects equal to those arising from the present way of manuring.

But supposing that one half should be required to produce the same effect, the benefit resulting, even from this difference, will be strikingly obvious. It will, no doubt, be said, that additional labour will be requisite to prepare and spread top-dreſsings; and that, after all, their effects will not be so permanent as in the common way of ploughing in the manure. These objections, however, will, we trust, have little weight. The first is, indeed, easily obviated: for if a given quantity of manure is made upon the farm yearly, and the whole of it be laid upon the soil, it is a matter of little consequence whether it is spread upon one, two, or three fields; the expense of carriage will be nearly the same in almost every instance, and the only difference will consist in a small additional expense for spreading, which will require to be done with more attention when top-dreſsings are employed, than when the manure is ploughed in: of course leſs will be spread in a given time, and more hands be required to spread it.

The objection to top-dreſsings not having permanent effects is, to appearance, better founded; and certainly, at first sight, most people would be inclined to smile at the idea of one cart-load of manure producing as much benefit as two. But as we have formerly taken notice of the proportion of dung that is buried, and lost, we need no farther argument to prove that a half, properly prepared, and carefully applied, will be equally useful as double the quantity, differently treated. But allowing the objection to be solid, which is by no means the case, when we reflect upon the difference between manuring 50 acres, or 100 annually, and take into account the increased produce in grain, and the increased bulk of straw and fodder which is to form an additional quantity of manure for the ensuing season, we will be convinced that the advantage arising from iously followed,

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succeſsful practice of many of the most
lligent farmers in the island, particularly
hose of Hertfordshire, Berkshire, Bedfordshire,
the lime-stone lands of the West Riding of
Yorkshire, &c. might here be dwelt on*.

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* These top-dreſsings not only supply the want of previous manure, but also when crops are sickly and backward in the spring, occasioned either by bad seed-times, frosts, or other causes, are attended with wonderful succeſs, and enable the crops to vegetate quickly, and to cover and protect the soil on which they grow from the ensuing droughts of summer. To their almost magical powers, the Hertfordshire farmers are principally indebted for their never failing crops. Without entering into any chymical analysis to discover the cause, they are satisfied with the effects, and therefore continue to enlarge upon the practice, though attended with con-

With them, top-dreſsings are in high repute, and experience has fully convinced them, that there is no mode of applying manure equally profitable. The following are the top-dreſsings ſucceſsfully used.

1. *Soot* from coals.—This is bought in London at 9d. to 11d. per bushel, struck. It is brought from London to the lands, and there deposited in a heap, which is the practice also with the other light dreſsings; from these heaps a common seed-scuttle is filled, and a man walking the length of the lands, sows the soot in the same manner as corn is sown; the expense of sowing is a halſpenny per bushel. The quantity used per statute acre, is from

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siderable expense. The provident farmer lays in a stock of dreſsings to answer contingencies, and provided with this treasure, he can remedy the evils of bad seed-times and seasons. These top or spring-dreſsings are peculiarly applicable to poor, light, sandy, and gravelly lands, and of course to the production of the specifically heaviest corn, and put such lands more on an equality in point of annual value, with stronger and richer soils. Happy would it be to more distant farmers, and agriculture in general, could an adequate substitute to the Hertfordshire dreſsings be procured at any expense, and were the application of that substitute perfectly understood.

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clover in the same month, and has a good effect sown *with* barley in the beginning of April, and harrowed in.—A slight dreſsing of soot is used at any time in the spring, when grubs or worms appear to injure the young corn; the worms frequently make great havock by drawing the blades of young corn after them into their holes; this soot best prevents.—Soot, thinly distributed on newly-sown turnips, *just before* they come up, prevents the fly or grub from injuring them, provided no rain falls to wash it into the soil; if sown after the plants come up, it injures them, particularly if the season comes dry. Soot answers best on light dry chalk soils, and in moderately wet seasons; it does little good on strong or wet land, or in very dry seasons, unleſs sown earlier than usual.—The London soot from coals is gene-

rally mixed with cork-dust, coal ashes, or sweeping of the streets; even in that adulterated state, it is found to answer much better than real country soot from wood.

2. *Coal-ashes.*—These cost in London from 6s. to 14s. per waggon load, (narrow wheels and four horses,) the price depending on the busineſs doing in the brick-fields near town, in which considerable quantities of ashes are used; carriage included, they cost on the land about 5½d. per bushel. Coal-ashes are bought in small quantities in the neighbourhood at 4d. per bushel; they are distributed on the land with a shovel from a cart or wheel-barrow moved along the land; another, and perhaps the preferable mode, is sowing them by hand: the former way costs 12d. per waggon load, the latter 18d. Coal-ashes are used from fifty to sixty bushels per statute acre for a complete dreſsing; which amounts from 23s. to 26s. per acre: they succeed well sown on clover in March or April, on dry chalk lands; and also do much good to sward, applied during any part of the winter or spring:—they are never used on wheat. In very dry seasons, coal-aſhes do little good, except on cold sward, which they

always improve: They, as well as most other of these dreſsings on light land, require rain after being sown, to set them to work.

3. *Peat-ashes.*—These are bought at the same price as the former; forty buſhels is a complete dreſſing for an acre, and coſts about 16s. Peat-ashes succeed well when used at the same time, and on the same crops as the last article, except that they apply on wheat in April with good effect;—they greatly improve dry chalk soils, but will do little good on wet land or cold sward, or hot sand lands. This, like moſt other top-dreſsings, is little affected by the season, provided wet falls soon after it is laid on the land.

4. *Peat-dust*—This costs the same as the aſhes, and is sown in the same manner and quantity; it answers equally well, and in every way the same as the ashes. Peat-dust is esteemed the best poſsible dreſsing for an onion-bed in a garden, and is not found to promote weeds more than other dreſsings; it has great effect on thistles, causing them to wither, as if scorched; but they generally recover unleſs the dust be repeated.

5. *Folding*—is used as a top-dreſsing on light lands; and on these it answers a good purpose: it succeeds best on dry land. Its effect on these light soils is not entirely attributed to the ſheep's dung, but in a great degree to the ſtiffneſs the land acquires by the treading, which is here found so very beneficial, that they frequently lead the plough horses abreast up and down the lands several times after sowing wheat, or other grain, to tread it.

6. *Furriers' Clippings.*—These are bought in London at 12s. to 13s. per quarter (being a ten bushel sack crammed full) weighing about 2½ cwt.—they are sown by hand from the seed-scuttle, at about 3d. per quarter, on land intended to be sown with wheat or barley, and immediately ploughed in, after which the seed is sown and harrowed in; such pieces of the clippings as are left above ground by the harrow, should be pricked into the ground by the end of a stick, to prevent their being devoured by dogs or crows, who seize them greedily: from two to three quarters are usually sown per statute acre. Clippings answer well on light, dry, chalk, or gravelly soils, where they are supposed to hold moisture, and help the

dry seasons; they have but
wet soils.

orn-shavings.—These are of two sorts, l or turner's shavings, and *large*, which nsists of refuse pieces of horn; the small are bought in London in the same way, and generally at the same prices as the laſt article; the large shavings coſt about 2s. leſs per quarter. Horn-shavings are used in the same way and quantities as the last article, except that they want no pricking, and the large are generally ploughed into the land three months before sowing wheat or barley. Horn-shavings answer in most soils and seasons, except very dry ones, when they will not work; the small shavings are much the most useful.

8. *Woollen Rags.*—These cost in London from 3s. 6d. to 4s. 6d. per cwt.—In the country they are bought at 4s. 6d. to 5s. and are collected at about 2½d. per cwt. The rags being generally in large pieces are housed and chopt at the expense of 5d. or 6d. per cwt. They are sown by hand and ploughed in three months, before sowing wheat or barley; the quantity used is 6 to 10 cwt. per statute acre. Woollen rags, like furrier's clippings, hold

moisture, and are adapted for dry, gravelly, and chalky soils, and succeed in dry seasons better than moſt manures: they do but little good on wet soils.

9. *Sheep-Trotters*, and *Fellmongers' Cuttings.*—These are bought of the neighbouring fellmongers at about 6d. per bushel, heapt loose. They are used in the same way as furrier's clippings, from 20 to 40 bushels per acre, and need pricking in, as dogs and crows are very fond of them. They do not answer on wet land, or in very dry seasons; indeed nothing does succeed in exceſsive dry seasons on these soils. The trotters contain a considerable quantity of lime, and are often adulterated with sand, and sometimes considerable quantities of oak saw-dust are mixed with them.

10. *Malt dust.*—This costs, at the neighbouring malt-houses, 1s. per bushel heapt; it is sown by hand from 24 to 32 bushels per acre, at the same time with barley, and harrowed in with the seed: it suits most soils and seasons. Malt-dust quickly spends itself, and is therefore never sown with wheat: as a top-dreſsing to wheat in March, about thirty bushels per acre,

it probably would succeed on these soils. Black malt-dust, or such as falls through the kiln-plate in drying, is greatly preferred to the white, on account of the seeds of charlock *(sinapi arvensis)* with which it abounds, being destroyed by the heat. Chalk lands, under their present management, produce such abundance of charlock, that they are generally obliged to mow off the heads and flowers, about the middle of June, to prevent its entirely smothering the corn. Charlock-seed so abounds with oil, that it will lay for any length of time in the earth without vegetating, which, however, it never fails to do, when brought near enough to the surface by the plough. Pigeons are supposed to pick up considerable quantities of charlock-seed after land has been ploughed. These lands are very subject to be overrun with black graſs, *(alopecurus agrestis,)* which is said to impoverish it much.

11. *Pigeons' dung.*—This costs 1s. per bushel, heapt; it is used as malt-dust, and does good in any soil or season.

12. *Rape dust*—is much used upon limestone lands that lie remote from large towns. Wheat requires two quarters and a half

per acre, and barley about three quarters. The farmers in the neighbourhood of Ferrybridge and Abberford, Yorkshire, pay for it about twenty shillings per quarter. It is harrowed in with the seed. For wheat it is a certain tillage; but if rain should not fall soon after barley sowing, the crop is sure to suffer.

13. *Soapboilers' Ashes*, or wood ashes from which lye has been made, is to be had (in small quantities only) at 6d. per bushel, heapt; the effect of these on cold sward is very great.

14. *Hog's Hair.*—This is sometimes to be had in London at about 9s. per quarter; when applied in the same manner as furriers' clippings, it is found to answer very well.

Notwithstanding the striking advantages arising from an attention to these points, the subject of manures is still considered by too many farmers as a secondary object; and much less care has hitherto been paid to collecting, preparing, and employing them in a proper manner, than they deserve. A considerable quantity is daily lost about every farm, that might otherwise be saved, and a very great proportion of what is collected is of little value, owing to the careleſs slovenly manner in which it is treated. Fermentation, it is well known, is eſsentially neceſsary to convert all animal and vegetable substances into good manures; but in too many instances this is never once thought of, nor is it a matter of inquiry, with such farmers, whether the small quantity which they have collected, in perhaps a very slovenly manner, is fermented or not. At a certain season of the year, and that often an improper one, it is laid upon the field; and the poor returns that are made, afford the most striking proofs of this execrable management.

It might naturally be supposed, that such farmers, by comparing their own miserable crops with those of their more intelligent and industrious neighbours, would be led to inquire into the cause of the difference. But so powerful is prejudice, and so obstinate and perverse is the human mind, when tinctured with particular notions, that few inquiries of this kind take place, and still fewer attempts are made to correct mistakes, however glaring, if sanctioned by long usuage. Every improvement, either in the form of an instrument of husbandry, or in the manner of cropping and manuring, is considered as an innovation, and reprobated accordingly. Thus men grow old in error! their children imbibe their prejudices, and follow the same path; and the ignorance and want of system of the former generation, are quoted as reasons for the folly and obstinacy of the present. This accounts, in a great measure, for the slow progress of improvement; and forms an obstacle much more powerful than either a barren soil or a rigorous climate. To say more upon this subject seems unnecessary; we shall, therefore, rest satisfied with preſsing the foregoing considerations upon the mind of every intelligent farmer; for to such only are they addressed.

A mistaken opinion has long prevailed with many farmers, that if dung has only the appearance of being rotten, its effects will be equal to that which has been properly fermented. This idea has been productive of much mischief. Some, indeed, carry it so far as to affirm, that dry straw, left in the field, will be converted into good manure; and trusting to this, they leave the stubble very rank, expecting to reap the benefit of it in the next crop. It is true that straw when left in this way, will decay, but surely if it had been mowed and brought into the straw-yard, it would have become doubly valuable.

Instead of a practice which has at least the appearance of negligence, every farmer ought to collect his straw with the utmost care, and endeavour, by every means in his power, to subject it to the process of fermentation, for in that way alone can it be rendered useful, and if proper attention is paid to cutting low in harvest, and leaving as little stubble as possible, one-third more straw at least may be got, in many parts of the kingdom; by which a very important addition would be made to the manure annually collected.

The dung of animals is the most common, the most useful, though not perhaps the best managed of any manure that is at present known. Previously to entering upon the way of using it, we trust a few observations upon the present defective mode of treating it, together with some account of its properties, the means of collecting, preserving, and subjecting it to the process of fermentation, and of increasing its quantity, will be thought of service.

When any considerable quantity, either of stable dung, or mixture of animal and vegetable substances, are collected together under certain circumstances of *heat*, *air*, and *moisture*, they begin to ferment, and exhibit all the different phænomena of fermentation, in a greater or less degree, till the process is finished. If we then examine the mass, we find that the vegetables of which it was originally composed, are decompounded and reduced to their first principles, and are again in a situation to afford food for new plants; by this means a perpetual succeſsion is kept up, and the decay or death of any of these, which at first view we might be led to consider as a misfortune, serves for their reproduction.

This point settled, it will readily be admitted, that the more completely such substances are subjected to the process of fermentation, the greater and more beneficial their effects will be upon the soil. It is, therefore, an object of the first importance with every person concerned in the cultivation of the earth, to manage their manures in such a way that they may be completely fermented, and to have their dunghills so situated and constructed, as to promote fermentation, and preserve the useful articles contained in the dung, both while the process is going on, and after it is finished. A careful attention to these points will not only improve the quality, but, as we shall afterwards see, increase the quantity of manure in an astonishing degree.

When fermentation has taken place for some time in a heap of manure, consisting either of animal or vegetable substances, or a mixture of both, the first alteration that is observed, is a change of colour and a sensible diminution of its bulk; as the process advances, the bulk continues to diminish till the fermentation entirely ceases. This diminution is owing to the solid parts of the maſs being brought more closely together. The fixed air and volatile alkali escape in the form of vapour, and the moisture falls to the bottom, where it either remains, if the dunghill is situated in a hollow, and has a bottom capable of retaining moisture, or runs off if it is situated upon a declivity. When this moisture is collected and carefully analyzed, it is found impregnated with the salts contained in the dung, and if spread upon the soil in that state, it will contribute to fertilize the land.

In collecting and preparing this manure, little attention has hitherto been paid, either to the scite of the dunghill, the encouragement of fermentation, or the preservation of the salts after the fermentation is finished.—Throughout the greatest part of Britain, it is painful to observe the neglect of this important article, particularly in those parts of the country, which, from their situation, are in a great measure deprived of every other means of improvement. Throughont the whole of North Wales, Cornwall, Cumberland, Westmoreland, and in short all the hilly and mountainous parts of England, this defect is common; nor is it leſs so in the Highlands, and most of the upland districts of Scotland. In those parts, the dung is generally thrown into the farmer's close, without considering either the nature of the bottom, its capacity for retaining moisture, or the chance there is of that moisture being drained off, if the dunghill is situated upon a declivity.

Accordingly we observe the greatest part of dunghills, either situated in hollows, and surrounded with water, which by chilling the maſs very effectually prevents fermentation; or upon declivities, where they are totally exhausted of every drop of moisture. In these cases the dung is thrown out careleſsly. Horses, cattle, hogs, and poultry are allowed to trample upon and spread it, and even carts and waggons are drove over it.

By this treatment it is preſsed into a maſs, too heavy and compact for the air to penetrate through a great part of it; the outside of the dunghill is scattered about, loses its moisture, and is either blown away by the winds, or returns to a state little better than dry straw, and when the season arrives for laying it upon the land, the whole is generally taken out, without considering whether it is fermented or not.

To a person who has paid any attention to the subject, the defects of this management must appear in a very ſtriking point of view. The middle of such a dunghill, from being hard preſsed, will be long in fermenting, and even in the end be very imperfectly fermented; and the sides, from being scattered about and dried, will not be fermented at all; we need hardly observe, that the consequences of this management will be a scanty crop, and disappointment to the farmer; this is the ordinary effect where dung is laid, even upon a plain surface.

When the dunghill is situated in a hollow, and has a bottom capable of retaining moisture, the consequences are equally bad, if not worse. The whole of the rain that falls immediately from the clouds, together with the water from the roofs of the surrounding houses, and the natural moisture of the dunghill itself, lodge there and chill it so as to prevent fermentation. It is certain that stable dung, in such situations, will have the appearance of being fermented, but upon examination it will be found only decayed; and from its being steeped so long in water, the greatest part of the salts will be extracted, and what remains, if carefully analyzed, will be found to contain scarce any other principle but vegetable earth.

Where a dunghill is situated upon a declivity, or has a gravelly bottom, the loſs is equally great, as in the two former cases; as the whole of the natural moisture that is preſsed out during fermentation, and which is strongly impregnated with the salts of the dung, either runs [illegible] or sinks into the earth; nor is this the only loſs that is sustained, every shower that falls, by paſsing through the maſs, carries off an additional quantity of the salts, till by repeated washings, the dunghill is left in nearly the same situation as tea leaves after a strong infusion has been drawn from them.

Finally, by throwing it out in the careleſs manner already described, taking no pains to lay it up regularly, and allowing cattle, &c. to tread upon, and carts to paſs over it, fermentation is long in taking place; even then it is partial and incomplete, and in place of producing good manure, abounding with rich well prepared substances, it will, for the most part, be found to consist of articles only half fermented, which, from their parts not being properly separated, are very ill calculated to promote vegetation. Dung is the most likely to be best, where the dunghill is upon level ground, and at some distance from the offices.

Having mentioned the present mode of collecting and preparing stable dung, and stated the *slothful* and *defective* manner in which it is generally done; we shall now proceed to offer some directions, as to the methods of promoting fermentation, and preserving the salts after the process is finished;

and lastly, of increasing the quantity of that valuable article.

To promote fermentation in stable dung, two things are essentially necessary, namely, air and moisture; without these no fermentation will take place, and unless they are in due proportion the process will be incomplete.

It is a circumstance well known to persons who are accustomed to prepare dung for hotbeds, that by laying it lightly together in heaps, and watering it gently, fermentation is immediately brought on. It is also known, that in the after stages of this business, hotbed dung is as completely fermented in the space of fourteen or sixteen days, as that in a farm-yard generally is in six or eight months.

Every farmer ought, therefore, to imitate this practice as nearly as the nature of his situation will admit, and in place of having his dunghill in the stable-yard, and allowing carts, cattle, hogs, poultry, &c. to trample upon and disturb it, he should place it in some distinct situation, convenient for his offices, the urine from which should run into receptacles, from which it might be thrown, without the trouble of carriage, into the dung, where it would be of the utmost use in promoting fermentation.

When it is driven to the dunghill, the cart or waggon in which it is carried, should not be drove over the dung, as is commonly practised; because, as we formerly observed, the feet of the horses and the weight of the carriage will press it so hard, that the air will be in a great measure excluded, and by that means fermentation prevented. It is disgraceful to see the common way in which this is done; the dunghill is for the most part in the form of an inclined plane; up this ascent, which is sometimes very steep when the quantity of dung is great, the cart is driven, and while the wheels are sunk nearly to the axles, and the horses are sunk above the knees, the merciless driver exercises his whip, and occasions the most cruel and painful exertions to the poor animals, straining their bodies, and destroying the harness more in the course of a few yards, than driving the same load would occasion in five or six miles.

If we inquire either of the farmer or his servant, what is gained by this exertion? he will only be able to say, that the load is laid upon the top of the heap; a labour which a man would readily perform, to much better purpose, in a few minuites.

The whole cart load ought to be laid down by the side of the dunghill, and afterwards thrown lightly upon it with a fork, the trouble of doing which would be trifling, and the advantage immense.

If dung laid up in this way contains a sufficient proportion of moisture, it will immediately begin to ferment, and the proceſs will be soon and completely finished: particular attention ought therefore to be paid to this circumstance; and if it any time the dung is laid up dry, it should be immediately watered. In summer this will frequently be found necessary, especially during dry weather; and as most farms poſseſs a sufficient command of water, it can very easily be done.

Where this method is had recourse to, the dung will be completely fermented in the space of six or seven weeks *, at the utmost,

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* A very intelligent Agriculturist recommends that no more than what can be collected in a month, should be formed into one dunghill. After the end of the month it should all be turned over, and thoroughly mixed, and left to heat again for another month, and turned over again; when it will be fit for use.

and in general will be found of one half more value than that which is made in the careleſs, slovenly manner we have described.

The importance of good manure to all agricultural operations is such, that we should naturally have expected to find every thing relating to it made a primary object with farmers. On the contrary, no part of the rural economy has been leſs the subject of inquiry; the situation and construction of dunghills in particular, though highly deserving of notice, have for the most part been considered as a matter of indifference.

As was formerly mentioned, a hollow is improper for the scite of a dunghill, from the circumstances of its lodging water, and preventing fermentation; a declivity is equally bad, as it serves to drain and carry off the moisture saturated with the richest salts of the dung. A gravelly bottom is worse than either of those, as the moisture sinks down into the earth, and is irrecoverably lost.

The situation best calculated for the scite of a dunghill, is that which is nearest to a level, with a bottom capable of retaining moisture, and, if poſsible, covered with a shed. The whole should be enclosed with a wall of, at least, four or five feet in height, with an open space at one end for carting away the dung. If the bottom is not clay, it should be laid with it, and paved above either with broad flags, or the common paving stones used for streets. At the end opposite to where the opening is left, a reservoir should be dug, which might either be lined with clay, and built round with stones, or fitted with a wooden cistern made water-tight, into which a pump should be put for drawing off the moisture daily.

This reservoir should be situated at the most depending part of the dunghill, with an opening in the wall immediately opposite to it. The pavement should have a number of channels of, at least, five or six inches deep, and of the same width, all feathering off to a main, or central channel, leading to the reservoir. These channels should be filled with brushwood before the dung is laid down, by which means they will be kept open, and the moisture find a ready paſsage to the main channel.

Every dunghill ought to be so situated as to have its longest sides run from east to west; surrounded by a wall, and covered with a roof. The wall on the south side of a dunghill should be of such a height as to prevent entirely the sun's rays from touching the dung; on the other three sides, however, there is no neceſsity for its being so high, six feet from the ground will be sufficient, and the roof may be supported by pillars. The expense of the roof, which need only be thatched, will soon be repaid by the superior quality of the dung. The perpendicular wall on the south side will very effectually prevent the sun from depriving the dung of its natural moisture.

The advantages attending this sort of dunghill will appear at first sight: the wall, by confining the dung, will keep it from being scattered about and lost, and will also preserve the sides of the dunghill from being dried, and rendered useleſs by the action of the air. The shed will keep it from being chilled or deprived of its salts by the rain paſsing through it, the wall will also prevent the moisture from escaping at the sides, and conduct it to the bottom. The pavement will prevent it from sinking into the earth, and the channels will conduct it to the reservoir, from whence it can be drawn by a pump into a barrel placed upon a cart, and either spread immediately upon the field, or mixed with other substances into a compost, or thrown upon the dunghill itself, it being the best of all ferments.

The quantity of manure may be increased in various ways, one of which has already been noticed, viz. securing the moisture that drains from the dunghill, and either spreading it immediately upon the soil, or mixing it into composts; another method, by which an almost equal quantity may be obtained, is, by collecting the urine of the horses and cattle in the stables; this may be done with great ease, by having a barrel or cistern sunk at each extremity of the stable, with a well-paved channel leading to it.

Another means of increasing the quantity of manure is, by gathering the dung of both cattle and horses that are feeding upon rich old pastures. Lands of this description need no dung, and the quantity that is annually dropt upon them, if carefully gathered, might be profitably employed upon the lands that are in tillage; upon poor pastures, however, this should not be practised, as a considerable

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substances that have been found, from rience, best calculated to increase the antity of manure, are earth, moſs, turf, the shovellings of highways, and the cleanings of ditches or drains; one or all of which may be found, in considerable quantity, upon every farm if carefully sought after. There are two ways of rendering these substances useful; the first is by laying them in the bottom of the dunghill, and suffering the moisture of the dung to soak down and saturate them; the second is to lay them in heaps by themselves, and collect the moisture of the dunghill and the urine of the cattle, and pour it upon them; in either of these ways, if proper care is taken, any of the substances we have mentioned will produce effects equal to the best manure; and if the whole of the urine and other excremental matters about every farm be collected and used in this way, the quantity of that sort of manure may be more than doubled in almost every instance.

Stable-yard dung is applied indiscriminately upon all soils, at all seasons of the year, and for every different crop; we have already noticed the loss attending the present mode of collecting and preparing it, and if we follow the farmer through the subsequent steps of his operations, we will discover that the system is equally erroneous and absurd. Of all the manures at present in use, none can be considered as so immediate a food for plants as stable-dung, and when it is applied to vegetables in a growing ſtate, this is strikingly exemplified, as they immediately begin to thrive, and continue to do so throughout the season. If this is admitted as true, and perhaps few will controvert it, how absurd must it appear to see farmers laying great quantities of rich well-prepared dung upon their fallows in the end of autumn, there to remain till the ensuing spring before the plants require the use of it; for if the fallow is sown with wheat, or any other crop that is to stand the winter, during a considerable part of that time the growth of the plants will be stationary, consequently they will need no nourishment; indeed if they only vegetate and establish themselves in the ground before winter, that is the utmost that can be expected. In the mean time, it is worth while to inquire what becomes of the dung. If it has been well fermented, the useful salts contained in it will dissolve very readily in water, and as it is doomed to remain in the earth during the whole of the winter months, a period during which the greatest quantity of rain falls, every shower will deprive it of something and when the spring arrives, and the plants begin to vegetate, a great part of what was originally destined for their nourishment will be discovered to have been washed away and lost by the winter's rain.

This is the first loſs that attends laying dung upon fallows in the autumn, and when duly considered, it will be found a very serious one; the other disadvantages attending the practice are equally great: where fallows have been well wrought, the soil is in general completely reduced, mixing it with dung in that state prevents it from acquiring a sufficient degree of compactness to shelter the roots of the plants. The operation of the winter's frost renders it still looser; so that in the spring it is found nearly in the state of a mole-hill; the baneful effects of this to a wheat crop are well known to every man of observation. Were a different method pursued, and at least a portion of the dung withheld till the spring, two very material advantages would accrue from the practice; the land would attain a greater degree of compactneſs, and would in general be found firmer in the ſpring, by which means the plants would be less liable to be thrown out of the ground by the frost, and if the dung were then applied as a top-dreſsing, vegetation would immediately commence, and the progreſsive growth of the crop would completely take up the useful parts of the dung every time it was moistened. In this shape, no part of it could poſsibly be lost, and from the small quantity that would be required for a dreſsing, three times the extent of land might be dreſsed annually, and it would not require so much time or labour as might at first be imagined. In treating afterwards of lime, it will be laid down as a rule, that a complete dose should be given at once; with regard to dung, the reverse ought to be the case; lime being intended to operate upon the parts of the soil, unleſs a sufficient quantity is laid on, the whole soil will not be acted upon, consequently its effects will be small: but dung being a sort of ready-prepared nourishment for the crop, if it is either applied at a time when the plants are in a dormant state, as is the case with wheat in winter, or if more is used than is sufficient for the wants of the crop, in either case it is washed away by the rain, and lost; whereas were it applied in a quantity sufficient only for the nourishment of the crop, the plants would be fed in the same manner as the animal body, every small dose operating like a meal. In this way it is utterly impoſsible that any part of the manure can be lost. For in the first place it it laid on when the plants have a demand for it; and in the second, by laying it upon the top, every drop of the moisture is interrupted in its passage downwards by the roots of the crop.

The practice of laying dung upon clover leys in the autumn, is equally absurd; for whether it is intended to continue the field in clover for another year, or to plough it down for wheat or oats, the mischief is great.

Where it is intended to let the field remain another year in graſs, a very material injury is sustained; a part of the dung is, in the first instance, washed away by the winter rains, and the remainder, in place of serving, destroys the plants; it being now well ascertained, that the action of dung upon broad clover, when the plants are not in a growing state, is fatal to them; in this case the farmer has the mortification of seeing not only his dung thrown away, but his crop lost.

But while we reprobate the laying dung upon clover before winter, we entertain a very different opinion of it, when used early in spring. At this season a light top-dreſsing of dung is highly useful to broad-clover, and and what is singular, the same plants that would have been killed by its operation, if laid on about the end of autumn, will be rendered strong and vigorous by using it in the spring.

Dung is frequently laid upon clover ley for wheat, and the seed put in upon one furrow. This is an injudicious practice; for if the graſs crop has been good, or even tolerable, the furrow will be turned over entire and the dung laid flat under it, and as the roots of the wheat must penetrate through the sod before it can reach the dung, little benefit can be expected from it, even allowing the qualities of the dung to remain unimpaired; but as was formerly observed, when speaking of the loſs attending its use upon fallows, the greatest part of it will be washed away by the winter rains: Indeed in this case the loſs will be greater than when it is laid upon fallow; for there it is incorporated with the soil, and a part of its salts will at least be entangled amongst the earth; but upon ley it is either laid in the bottom of the furrow, or if the sod is set up on edge, it remains crammed into the interspaces, through which the whole of the rain paſses that falls upon the field: for when a shower falls upon a field of ley that has been recently ploughed, in place of every drop sinking down where it falls, as is common upon other lands, the plexus formed by the roots of the graſs, together with the polish given by the plough, renders the body of the furrow ſo compact. as to make it in ſome meaſure impervious to water; in that caſe, the rain which falls upon the body of the furrow, in place of penetrating it, will run off and ſink down into the interſpace, where it muſt neceſſarily paſs through the dung, and in its paſsage will diſſolve and carry down a part of the ſalts during the whole winter; this will happen after every ſhower: and in the ſpring, if ſome of the dung that has lain in this ſituation, is taken up and examined, it will be found nearly deſtitute of every fertilizing quality. Upon this abuſe we think it unneceſſary to ſay more.

The objections that have been made to laying dung upon ley for wheat, apply equally to oat crops, with this additional one, that if the land has been well laid down and the graſs good, there is an abſolute certainty of a good crop of oats without dung. It may not be improper to obſerve, in this place, that the oat is a grain which requires lime or dung much leſs than almoſt any other; as we daily ſee tolerable good crops of oats raiſed, without the aſſiſtance of either, and that too in ſituations where no other ſort of grain will grow; the uſe of dung upon ley for oats is therefore unneceſsary; but if the land is poor, and dung is required, it is impoſsible to employ it in any way that will be so useful, as in the form of a top-dreſsing, at the time the seed is sown. When used in this way, there is an absolute certainty of the crop reaping every possible benefit from it, and even of the soil being enriched. When ploughed in, none of these are answered to equal advantage.

Perhaps there is no way in which dung is used where its effects are so certain and visible as upon potatoes and turnips; the principal reason of this is the season at which the dung is used. For potatoes it is laid on when the spring is pretty far advanced, after which there are few heavy rains; of course the strength of the dung is not impaired by washing, and the crop is left in quiet poſseſsion of the whole of its fertilizing powers. For turnips the case is nearly the same; indeed the advantage is still greater, as dung is never laid upon turnip land sooner than June, after which there is seldom much wet weather till autumn, and by that time the crop is in full vigour. These two instances of the certain effects of dung, are mentioned merely with a view to show the propriety of using it at a season of the year when the crop for which it is meant is in a growing state, and can absorb the useful parts of it. There is scarce a single instance of its failing (unleſs from bad seasons) when applied in this way; on the contrary, when used in the autumn it is often lost.

Farmers differ as to the proper time of laying on dung upon meadows. Some prefer the spring, producing, they aſsert, an early vegetation, and a plentiful crop. But others are of opinion, that though dreſsings of soot and fine ashes, at that season of the year are of much use, yet that dung ought to be laid on at the end of autumn, to warm and invigorate the young shoots during winter.

The above comprehends nearly the whole of the different modes of using stable dung; in considering which, we have freely pointed out the abuses that prevail in the present system, and attempted to lay down rules for better management in future. We shall now conclude with some directions about separating the different sorts of manure made about farms, together with a few observations by way of a result from the whole.

Perhaps there is nothing that calls more loudly for reform than the custom most farmers have of collecting manure of every description, and laying it up in one dunghill. By this mode of management, substances very opposite in their nature, and which may be wanted at different times, are laid together, and in place of forming *useful* combinations, they are prevented from fermenting, and being rendered useful. We would, therefore, propose to every farmer, to have at least, two or three dunghills; in which, according to the time at which the contents of each may be wanted, and the articles of which they are respectively composed, they may be prepared for use.

If *earth*, *moſs*, or the *shovellings* of *highways*, can poſsibly be procured, the bottom of any dunghill in which either rank stable dung, or short excremental dung may be laid, should be covered to the depth of three or four feet with these substances before any of the dung is laid on. This method, if properly followed, will increase the quanty of manure considerably; for while the fermentation is going on, the moisture that is preſsed out during the proceſs will sink down into the *earth* or *moſs*, and impregnate it completely with the virtues of the dung; and if the whole is afterwards turned and incorporated, the earth or moſs that was laid in the bottom, will be found of nearly equal value with the dung itself.

Some distinctions are to be made regarding the various sorts of animal dung.

1. *Horses*. The dung of horses is more distinguished for the readineſs with which it ferments, than for its intrinsic richneſs. In its raw state, it is well calculated for potatoes, leaving room in which the roots of that plant may expand; but, unleſs when fermented, it is apt to produce many sort of weeds, the seed of which may have got into the food of the animal, as it contains much undigested vegetable matter, and should never be used but when fermented.

2. *Black cattle*. The dung of black cattle is the most useful, particularly for lean, dry, or sandy soils. It is held, that the dung of a ruminant animal, as an ox, is preferable to that of horses at graſs, owing to the quantity of animal juices mixed with their food in chewing; not containing much undigested matter,

it will hardly heat. It would be of use, if means could be found to make it ferment like horse-dung. The best way of managing it is, to lay it together, and keep it moist till it is sufficiently putrified.

3. *Sheep.* The dung of sheep by itself, is an excellent manure. In Holland it is collected on the fields, carefully cut into small pieces, and sold in baskets at a high price. Its benefit is principally obtained in this country by folding.

4. *Hogs.* Swine's dung, in the opinion of Dr. Hunter, is the richest of the animal manures. He aſserts, that the fatter the animal, *cæteris paribus*, the richer the dung. Hence arises the superiority of this article. It is of an oily and saponaceous quality, and when made into a compost, and applied with judgment, it is excellent for arable lands.

5. *Pigeons' dung* is certainly a rich manure, but the effect is sudden, and as it does not last long, it must be the oftener renewed. It is most applicable to cold and deep stiff land. Sometimes it is sown upon wheat crops in the spring. It should always be broke very small

and sown during moist weather, and if circumstances will admit of its being harrowed in, so much the better. Poultry manure is of the same nature, and where it can be had in any quantity, is an excellent dreſsing, particularly for cold land. Columella ranks it next, in point of value, to the dung of pigeons.

6. *Night soil* is found to be an excellent manure, and if care were taken great quantities might be collected.

As it is perhaps the richest of all manures, there can be no doubt of the farmers being so desirous of obtaining it; but on account of its richneſs, it ought to be used, when unmixed, in smaller quantities, at least a small quantity of lime thrown occasionally into the neceſsary-house would be of great service. *Saw-dust*, *peat-moſs*, or any of the common soils will likewise be highly useful by absorbing the urine and moisture, which would otherwise run off into the common sewer. Where a certain proportion of lime is used, the excremental part will soon be deprived of its smell, and rendered so short and dry that it may with ease be employed as a top-dreſsing, or even used by the hand if properly broke; indeed it should never be employed in any other way, as it is by far too concentrated a nourishment to use by itself.

Two cart loads of ordure mixed with ten loads of earth, and one of lime, will be a sufficient top-dreſsing for an acre; its best effects, when used in this shape, will be upon light lands for wheat or barley; for wheat it should be used early in the spring, and for barley should either be scattered upon the young crop, or harrowed in with the seed. It is also particularly convenient for all drill crops.

Urine of every sort is found of great use when laid upon graſs, or young crops early in the spring. Applied in this way, it never fails to produce a plentiful and early vegetation. The most convenient way of using it, however, seems to be in the form of a compost, with earth or peat moss, with a small proportion of lime. In this shape it will be found a good manure for most soils, particularly light, sandy, or gravelly lands.

Great quantities of this article might be saved, and if judiciously used, will insure, at least, one or two good crops; about all farms and great towns it may be collected into reservoirs, along with other excremental matters, with very little trouble. In other countries this is an object of police, particularly in the towns where reservoirs are established in convenient places for collecting it. It is scarcely conceivable the advantage which the public receives from this arrangement. The neighbouring farmers carry it away in barrels, and either spread it immediately upon their fields, or mix it into composts with earth and other substances, and find it of the utmost service to vegetation: what might not be expected if the same attention was paid to collecting it over the whole of this kingdom!

Bones are used with succeſs as a manure in many parts of England, both by themselves, and in conjunction with other substances. The ordinary way of treating them is to break them with a mill, into pieces about the size of a marble; they are afterwards laid upon the field in small heaps, at regular distances, and covered with earth; after remaining in this state for some time, they are spread on fallows, on graſs, and on turnip land.

The constituent parts of bones are oil, alkaline salts, and animal earth. united by fixed air. The oil is in much greater proportion than the alkali, which renders bones rather a heavy manure.

It does not appear, that much pains is taken in adapting them to the soil for which they seem best calculated, being laid indiscriminately upon land of every description, and for the most part unmixed with any other substance. To a person acquainted with the nature of bones, this management will readily appear defective, for as they are kept together by fixed air, unleſs they are either laid upon soils poſseſsing principles that are capable of depriving them of this air, or have something of that kind previously mixed with them, the texture of their parts will remain unbroken, and they will be of very little uſe. In Hertfordshire, however, they are found an excellent manure for clay soils.

To render bones useful, the first step ought to be, to grind them as small as poſsible, and the more thoroughly this operation is performed, the more valuable will be their effects. This point once gained, we must look for a substance that is capable of dislodging the fixed air, and disuniting the principles contained in the bone. For this purpose nothing will be found so useful as quick lime*. In treating of that article, we will take notice of its quality of diſsolving oils and fat substances, and that this quality is increased by its union with alkaline salts. This effect is produced by the lime depriving the alkali of its fixed air, and rendering it more caustic.

When bones are used in their simple state, without the addition of earth or lime, they ought never to be laid upon any but the sharpest and most active soils, such as limestone, chalk, or gravel, upon all of these they will meet with more or leſs calcareous earth, which will, in some degree, disengage their fixed air, and diſsolve the oil contained in them, but upon deep clays, tills or loam, they should never be applied in that state, as these soils contain little calcareous earth; of course they will have little effect upon any oily substance.

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* Mr. Paget recommends mixing them in a heap with lime, which soon reduces them to powder. *Leiceſter Report*, p. 19.

But when made into a compost, they may be applied with advantage upon soils of every description, taking care to observe the same rules as were laid down for using stable dung, that is, never to plough them in, but always to lay them upon, or very near the surface, and never to use them but when the crop is in a growing state; for the effects of bones prepared in this way will be found not only more sudden, but their valuable qualities will be more in danger of being washed away by rain than in cases where they are used by themselves. They will, therefore, require to be laid on very thin, allowing, as near as can be ascertained, a quantity sufficient only for the nourishment of the present, or at most, the succeeding crop, and never to use them for broad-cast crops in any other form than as a top-dreſsing, and at a time when vegetation is either about to commence, or is actually going on. Upon wheat they should be used early in the spring, without harrowing; upon barley or oats they may be harrowed in along with the grain.

For drill crops, such as turnips, beans, &c. they are particularly convenient, as they admit of being sown into the drill at the same time with the seed, more readily than most of the other manures, and as we have already said, when speaking of stable-dung, the leſs manure that is laid between the drills, so much the better, as what is laid there is either lost or serves to nourish weeds, which the farmer is attempting to destroy.

On Putrid Animal Substances.

All animal substances, without exception, are good manures, if properly managed; when used by themselves they ought always to be laid upon the sharpest and most active soils, such as chalk, limestone, &c. but upon strong clays, or deep loams, they should never be used but in the form of a compost.

The most proper way of preparing these for use, is by mixing them with chalk or quicklime; the mixture should be laid in heaps of three or four cart loads each, and covered with earth; after remaining in this state for eight or ten days, the heap should be turned over, and about ten cart loads of earth added to every cartful of the former mixture. It should then be allowed to remain for a month in this heap, at the end of which time it will be ready for use.

This compost ought never to be ploughed in, but always used either as a top-dreſsing, or harrowed in along with the seed. Upon wheat in the spring it will be found a good manure; indeed upon every sort of grain it may be used with safety and advantage. It may likewise be used for drill crops in the same manner as was mentioned for bones.

Much of this manure might be collected about all great towns, where the refuse of slaughter-houses is frequently thrown away; which, if gathered together and covered with earth and lime, would not only rid the inhabitants of a nuisance, which offends their senses and endangers their health, but would produce profit to the community.

We shall now conclude with the following observations: 1. That as animal dung, in general, contains more oil than alkaline salts, that it is best calculated, when used by itself, for chalky, limestone, or gravelly soils. 2. When used as a compost, that it should be mixed with earth and lime. 3. That it should be completely fermented, before it is made into a compost. 4. That when mixed with earth and lime, it is exceedingly proper for all deep soils.

5. That whether it is used as a compost, or by itself, it may be applied with much advantage as a top-dreſsing. 6. That as a top-dreſsing, it ought never to be used but in the spring season. 7. That it may be applied with the greatest benefit when the crop is in a growing state, and can absorb and take up the nourishment it contains.

In the preceding observations, as little allusion as poſsible has been made to chemical doctrines, this paper being intended for the use of the practical farmer. It may not be improper, however, briefly to mention those authors whom the reader may consult, as furnishing materials more immediately connected with the philosophy of Manures.

The discoveries made by Dr. Priestley and Mr. Cavendish, relative to airs or gaſses, and the composition of water, and Mr. Bertholet's Papers on the Composition of Animal and Vegetable Mucilages, are of immediate application to Agriculture. Dr. Ingen-Housz, and M. Haſsenfratz, have suggested some new and important principles, concerning the nutriment of plants; and Mr. Kirwan's excellent Paper on Manures, printed in the Irish Philoſophical transactions, confirms the theory of these gentlemen, and applies it to practice. Lord Dundonald has been laudably employed in applying the new chemistry (without a knowledge of which this subject cannot be thoroughly understood) to agricultural improvements, by the publication of his valuable work, which contains many important facts, not elsewhere to be found. Regarding the great department of calcareous Manures, the reader is referred to the fundamental discoveries of the celebrated Dr. Black, in his Paper on Alkaline Subſtances, published in the Literary and Physical Eſsays of Edinburgh, in 1755; and to the chemical Eſsays of the Bishop of Llandaff, who throws new light upon every subject he undertakes to illustrate. Dr. Home, Dr. Fordyce, and Dr. Hunter, have also made many interesting observations, not only on agricultural subjects in general, but upon Manures in particular.

It is more than probable, that from the attention which philosophers have recently paid to vegetation, some discoveries may be made, of the utmost importance to agriculture, which may contribute very materially to augment the sustenance, and consequently to promote the moſt eſsential interests of society. But more facts are wanting to form a theory of important application in practice. Experiments are wanting to show the substances contained in different soils, to explain the comparative powers of different substances in nourishing plants, and to ascertain the greatest quantity of nourishing matter which can be produced in different circumstances. There is no doubt that the lands of this island, if cultivated in the most advantageous manner, would furnish aliment for thrice the number of its present inhabitants; and it is not improbable, that by a judicious selection of plants for the nourishment of cattle, or by extending the system of watering of land, where it is applicable, that animal food might be obtained in far greater quantities from the same lands, than at present. If the wealth of a nation depends upon the number of its inhabitants, and if that number depends upon the abundance of food which a country poſseſses, it naturally follows, that Agriculture is the moſt important political object to which the legislature of any state can direct its attention; and that the nearer it is brought to perfection, the more a nation is likely to enjoy internal happineſs, and external prosperity.

ESSAY XIII,

On Cottages with Gardens.

AS it seems to be the disposition of gentlemen to erect cottages upon their estates, with small portions of land to be formed into gardens, I shall here present the industrious labourer with a plan to direct his labours throughout the year. Some people may object to this method of bettering the condition of the cottager; conceiving that it may be the means of abating his industry, as a labourer, in the service of the farmer; but, it is experimentally proved, that a day-labourer, with an industrious family, has a sufficiency of time for the management of a small garden, after he has performed the labours of the day.

The Society, established for "Bettering the condition of the day-labourer," have, in my opinion, extended their ideas too far, in the directions given for the "management of a cottage garden, throughout the year."—If the cottage be remote from a market-town, it will be better, that the garden shall contain nothing but what may be consumed by the family: Turnips, cabbages, for all seasons of the year, Scotch-kail, onions, carrots, leeks, brocoli, potatoes, peas, beans, parsnips, radishes, parsley, pot-herbs, gooseberry-bushes, and perhaps, a few bee-hives; a few apple and plum-trees, may be advisable: but the present occupier cannot look forward to any advantage from them. Thus circumstanced, the bond of union between the day-labourer and his employer, will be firm and lasting; but when land is added to the cottage, for the support of one or two cows, the whole system is changed, and the cottager is made to approach too near to the small farmer, who is known to drag out a miserable life between poverty and hard-working. When the day-labourer is able to purchase a cow, it should always be kept by the farmer, and paid for out of the weekly earnings: this is upon the supposition that the cottager has an industrious family, and is rising in the world in consequence of his industry and attention. The face of things is now changed: the man may venture to keep a pig; his wife may raise poultry; and the garden may be so enlarged, so as to supply the family with something to carry to market. The labourer and the farmer being upon good terms, he may be able to obtain a rood of land, for the purpose of growing a few bushels of buck-wheat, or barley, for supplying the housewife with occasional food for her poultry. This is the smiling picture of an industrious cottager and his family; and as example is better than precept, I shall beg leave to realize the picture, by introducing the life of Britton Abbot, written by Thomas Bernard, Esq.

" Two miles from Tadcacter, on the left-hand side of the road to York, stands a beautiful little cottage, with a garden, that has long attracted the eye of the traveller. The slip of land is exactly a rood, enclosed by a cut quick hedge; and containing the cottage, fifteen apple-trees, one green gage, and three wine-sour plum-trees, two apricot-trees, several gooseberry and currant bushes, abundance of common vegetables, and three hives of bees; being all the apparent wealth of the poſseſsor. The singular neatneſs and good order that marked every part of this little domain, and some circumstances respecting the owner, which had been mentioned to me by Dr. Burgh of York, made me anxious to obtain the history of the cottager and his family. In the end of May, 1797, I called there in my way from York; but found the house and the gate of the garden locked. In the road to Tadcaster, however, I met his wife, laden with a basket of provisions from the market; and engaged her to find her husband, who was at work about a mile off, and to send him to me at the inn at Tadcaster. When he arrived he very willingly gave me his history as follows—

"His name is Britton Abbot: his age sixty-seven, and his wife's nearly the same. At nine years old he had gone to work with a farmer; and being a steady careful lad, and a good labourer, particularly in what is called task-work, he had managed so well, that before he was 22 years of age, he had accumulated near 40l. He then married and took a little farm at 30l. a year; but before the end of the second year he found it prudent, or rather neceſsary, to quit it; having already exhausted, in his attempt to thrive upon it, almost all the little property that he had heaped together. He then fixed in a cottage at Poppleton; where, with two acres of land, and his common right, he kept two cows. Here he had resided very comfortably, as a labourer, for nine years, and had six children living, and his wife preparing to lie in of a seventh, when an enclosure of Poppleton took place; and the arrangements made in consequence of it, obliged him to seek for a new habitation, and other means of subsistence for his family.

" He applied to Squire Fairfax, and told him that, if he would let him have a little bit of ground by the road side, " he would show him the *fashions* on it." After inquiry into his character, he obtained of Mr. Fairfax the ground he now occupies; and with a little aſsistance from the neighbours, in the carriage of his materials, he built his present house; and planted the garden, and the hedge round it, which is a single row of quick, thirty-five years old, and without a flaw or defect. He says he cut it down six times succeſsively when it was young. Mr. Fairfax was so much pleased with the progreſs of his work, and the extreme neatneſs of his place, that he told him he should be rent free. His answer deserves to be remembered: " Now, Sir, you have a pleasure in " seeing my cottage and garden neat: and " why should not other squires have the same " pleasure, in seeing the cottages and gardens " as nice about them? The poor would then

"be happy; and would love them, and the
"place where they lived; but now every little
"nook of land is to be let to the great farmers;
"and nothing left for the poor, but to go to
"the parish."

"He has had seven children; six of whom attained to man's estate; and five are now living, and thriving in the world. His son has a little farm near Helmsley Moor: one of his daughter's is the wife of a joiner at York; another, of the occupier of a little farm at Kelfield; a third of a labouring man, who has a little land of his own, near Duffield; the fourth is the wife of a labourer, who has built a cottage for himself at Tadcaster, and wants nothing (as the father observed) but a bit of ground for a garden. Britton Abbot says he now earns 12s, and sometimes 15s. and 18s. a week, by hoeing turnips by the piece; setting quick, and other task-work: "but to be sure," he added, "*I have a grand character in all* "*this country.*" He gets from his garden, annually, about 40 bushels of potatoes, besides other vegetables; and his fruit, in a good year, is worth from 3l. to 4l. a year. His wife occasionally goes out to work; she also spins at home, and takes care of his house and his garden.

He says, they have lived very happy together for forty-five years.—To the account that I have given, it may be needleſs to add, that neither he, nor any part of his family, has ever had occasion to apply for parochial relief.

"Though my visit was unexpected, and he at the latter end of his Saturday's work, his clothes were neat and sufficiently clean: his countenance was healthy and open; he was a little lame in one leg, the consequence of exposure to wet and weather. He said he had always worked hard and well; but he would not deny but that he had loved a mug of good ale when he could get it. When I told him my object in inquiring after him, that it was in order that other poor persons might have cottages and gardens as neat as his, and that he must tell me *all his secret*—how it was to be done; he seemed extremely pleased, and very much affected: he said, "nothing would "make poor folks more happy, than finding "*that great folks thought of them*:" that he wished every poor man had as comfortable a home as his own; not but that he believed there might be *a few thriftleſs fellows*, who would not do good in it.

"I asked him whether he had not a cow. He said he had had one, and she had died; and having no other place but the lane to keep his cow, he had not attempted to get another. "Could you get land, if you had a cow?"—He thought he could.—"Supposing then," I added, "a cow could be bought for 12l. and "you could rent it on the terms of paying "down 3l. 10s. immediately; and then 3l. 10s. "at the end of each year during three years; "and that the cow was to be yours at the end of "the three years, if she lived, and you paid "your rent regularly:—Do you think such a "bargain would answer for you?"—Yes, he said, he was sure it would very greatly; and there were few cottagers to whom it would not be a very great advantage; especially where they had a family of children. I told him to inquire whether he could get a little land, and I would have some more talk with him about it, when I came down in August.

OBSERVATIONS.

"The history of Britton Abbot appears to me to merit attention. At the time of the enclosure of Poppleton, when he had six young children living, and his wife preparing to lie in of a seventh, his whole little system of economy and arrangement was at once destroyed; his house, his garden, his little field, taken from him; and all his sources of wealth dried up. With leſs succeſs in his application for the rood of land, the spot in which his industry was to be exerted, and, in justice to him it must be added, with leſs energy than he poſseſses, he might have gone with his family into a workhouse; and, from that hour, have become a burthen to the public, instead of being one of its most useful members. Observe for a moment the effects of his well-directed industry. Without any parochial aid, he has raised six of his seven children, to a state of maturity; and has placed them out respectably and comfortably in the world. Five of them are now living, in the middle period of life; and he continues, at the age of sixty-seven, a good working labourer; happy in his own industry and good management, in the beauty and comfort of his cottage, and in the extreme fertility of his garden.

" Britton Abbot poſseſses a degree of energy and spirit, that we must not expect to find in every cottager. If, however, the poor do not exert themselves, and have not so much forethought and management as might be wished, the fault is leſs in them, than in the system of our poor laws, and in the *manner* in which they are executed. Were they properly and universally encouraged to industry and economy, we should soon find thriving and happy cottagers in every part of the kingdom. Let only a tenth of the money, now spent in workhouses, in what is usually called "*the relief of the poor*," be applied in aſsisting and encouraging them to thrive and be happy in their cottages, the poor's rate will be leſsened, and a national saving made both in labour and food*. The labourer is capable of more exertion, and is maintained for leſs than half the expense, in his cottage than in a workhouse. In his cottage he has his family around him, he has something he can call his own, he has objects to look forward to, and is the master of his own actions.—*Domestic connexions, property, liberty, the hope of advancement*, those master-springs of human action, exist not in a workhouse.

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* This experiment would be easily tried. Suppose the poor's rate of a parish, so applied, to be 600l. a year; and that 60l. a year of the rate were to be annually employed in aſsisting the most industrious and deserving labourers, to become poſseſsors of cottages and cows: I am confident the poor's rate of that parish would be greatly diminished in a few years; probably to half its present amount. The difference between a law that *encourages* the poor to exertion, and one that attempts to *compel* them to it, is, that in the first you have the co-operation of the millions of the people who are to be the objects of the law; in the second, all the labour is thrown on *the unfortunate and unſucceſsful persons*, who are to attempt to execute it.

" It is the misfortune of this country, that the well-disposed and industrious poor do not receive sufficient aid or encouragement. They find no distinction made between them and the idle and profligate; except this—*that the idle and profligate are maintained in part at their expense.* As the law is too frequently executed, the cottager, *though poor himself*, is regularly afſeſsed *for the relief of the poor;* but he receives no benefit from the fund, no afſistance towards the support of himself and his family, unleſs he is reduced to absolute want, and presents himself hopeleſs at the door of the workhouse.

" The evil has been greatly increased by the ninth of George I. which authorises the farming of the poor, and refuses relief to those who will not submit to reside in the workhouse [*]. It is, in consequence, the interest of the farmer of the workhouse, to keep it in such a condition, that (to use Mr. Parry's words [†]) "the honest and industrious labourer, "who has brought up a large family with "credit, and who, from misfortune, is poor, "and, from age, past his labour, will submit "to be half starved, rather than take up his "abode amid such wretchedneſs and pro-"fligacy." By these means, workhouses become objects of terror to the honest and industrious, and at the same time the favourite resort of the diſsolute and abandoned; the dirt, the waste, the disorder, the want of regulation, and the *undistinguishing treatment* [‡] of the worst and best characters, being as gratifying to them, as they are irksome and disgusting to the well-disposed poor.

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[*] An act has been lately paſsed (in December, 1795,) empowering the magistrates to order the cottager, under special circumstances, temporary relief at home. It has not, however, been attended to in some districts; and in others, the execution of it is very unwillingly submitted to by parish officers.

[†] See the first Report of the Society for bettering the condition of the poor.

[‡] An English workhouse is the only place upon earth, where the idle have the same allowance of food, and the same accommodation, as the industrious. In the table of diet of the Rasphouse at Rotterdam, there is a great dif-

" Let us consider what must be the effect of this system on the cottager.—Tenant to the farmer who has taken his cottage over his head, he is aware that his new landlord will require as much rent as he can contrive to pay. He has a young and increasing family; and, when times are at the best, he often finds it as much as he can do to go on, from one day to another, in their support. He can hardly expect that, during the severity of the winter, the high price of bread, or the visitation of sickneſs, his earnings will always, and at all seasons, continue equal to the neceſsities of his family. If the hour of adversity arrives, he knows the rule of his parish, that " *no assistance is to be given to the labourer, while he poſseſses any thing of his own;*" and that what with much labour and much self-denial, he shall have saved, must all be exhausted

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ference made between those who do full work, and those who only work *half task*. In the establishment at Munich, mere neceſsaries are allowed for those who do not work—for those who do, comforts and luxuries.

and spent, before his claim to parochial relief can be admitted. It may be well to consider what incitement *he* has to thrift and forethought. Can we confidently answer for ourselves that, so circumstanced, we should act even as well, and look as much to futurity, as he does, or that we should not be made mere sensualists by despondency? Is it perfectly clear, that we should not spend every penny, that could be spared from the daily nourishment of our families, in self-indulgence at an ale-house?

" Happy should I be, if I could make use of the history of Britton Abbot, to obtain for the labourer, encouragement to imitate the energy of his industry. Of the different modes of aiding and animating the poor, none would have more tendency to raise them above the want of parochial aid, than that of enabling them progreſsively to follow his example, in such a manner, that the most deserving might in their turn, become the owners of comfortable cottages and productive gardens; a measure which seems to be peculiarly called for by the present condition of the dwellings of the poor. It is a melancholy fact, that, in most parts of England*, their habitations are not only comfortleſs and devoid of accommodation, but insufficient in number; and that honest and industrious families are frequently driven into the work-house, merely for the want of cottages in their parish.

"If the custom of setting apart ground for them to build upon, were to obtain generally, and in a manner to induce and enable them to take the benefit of it, it would aſsist in gradually correcting this national and increasing evil, and in supplying that useful claſs of men with proper habitations.—It would have other very important effects. It would diminish the calls for parochial relief; it would encourage and improve the good habits of the poor; it would attach them to their parishes, and give them an increased interest and share in the property and prosperity of their country. The land required for each cottage and garden, need not be more than a rood; the value of which would bear no poſsible comparison to that of the industry to be employed upon it. The quarter of an acre that Britton Abbot enclosed, was not worth a shilling a year. It now contains a good house and a garden, abounding in fruit, vegetables, and almost every thing that constitues the wealth of the cottager. In such Enclosures, the benefit to the country, and to the individuals of the parish, would far surpaſs any petty sacrifice of land, to be required. FIVE UNSIGHTLY, UNPROFITABLE, ACRES OF WASTE GROUND, WOULD AFFORD HABITATION AND COMFORT TO TWENTY SUCH FAMILIES AS BRITTON ABBOT'S.

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* There are some parts of England, particularly in the northern counties, where the habitations of the poor are very comfortable; and other parts, in which the public spirit and benevolence of individuals have done, and are doing, much to improve them in their own neighbourhood. Picturesque cottages might be so disposed around a park, as to ornament and enliven the scenery with much more effect, than *those misplaced Gothic castles, and those pigmy models of Grecian temples*, that perverted taste is so busy with: but it is the unfortunate principle of ornamental buildings in England, that they should be *uninhabited* and *uninhabitable.*

"In order to encourage the exertions of the labourer, I should hope that this would be conceded to me, that the rood of land, enclosed for his cottage and garden, (on condition of a house being erected) be held in fee simple; and that so long as a parishioner, labouring generally within his parish, continued owner and occupier, such cottage and garden should, by parliamentary authority, be exempt from rent, taxes, rates, tithes, and all burthens whatsoever. It would be an important object to keep these little freeholds in the hands of the labourers of the parish; so that they might be transmitted from father to son, like those little estates, which we contemplate with so much pleasure in Burrodale. If, therefore, the exemption from rent, taxes*, &c. continued no longer than while the cottage was both the property and residence of a parishioner, generally working within his parish, it would not be of half as much value to any other person, as to him for whom it was originally intended;

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* The exemption from land tax would create another exemption; that of not having to attend county elections. It might be proper that no settlement should be effected, or varied, by any ownership, or occupation, of these cottages: and that the performance of the condition, by the erection of the cottage, should be certified and recorded at the quarter seſsions. The rent to be paid by a stranger, should not be leſs than a guinea a year; to be distributable in fuel among the poor of the parish at Christmas. This would serve at once as a penalty on the intruder, and as a compensation to the parishioners.

and if in some instances they got into other hands, they would soon return again into the poſseſsion of the labouring parishioner.

" As the means of promoting industry and good conduct among the poor, I should hope that a preference would be given to " industrious parishioners, members of friendly societies;" and that the character of the man, the number of his children, and other circumstances, would induce the farmers to give him the carriage of his materials, and his other neighbours to help him with a pecuniary subscription*. The annual sum of 10l. or 20l. so collected in a parish, and impartially and publicly given, as a premium to the most deserving labourer in that parish, (either to aſsist him in erecting his cottage, or to enable him to purchase his cow) would produce a great effect on the good habits of the poor; and, while it rewarded merit, would stimulate others to follow the example.

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* When a young man in New England has saved a little money towards erecting his house, he applies to his townsmen for aſsistance: they fix the time, and all of them attend to get the building up. I have known one of those houses erected and covered in, in the course of a few days.

"It would have other important effects.—It would greatly diminish parish rates*; for he who poſseſses a freehold cottage and garden, or a cow, has seldom, if ever, occasion to apply for parochial relief. By attaching the cottager to his own parish, it would secure to the farmer a certain supply of labourers, and would equalize, and keep down the price of labour, now much enhanced by the disposition to wander about, in quest of the highest wages and the easiest work; a disposition which has occasioned a considerable waste in the produce of national labour. But this would not be all. Freehold cottages and gardens, do not only attach the owners to their country, but are also the surest pledges and securities for their conduct. The cottager, who has property, is habituated to set a higher value on himself, and on his character, and seems to be of a superior order of men. Besides this, the addition, which these little freeholds might make to the industry, morals, and produce of a country*, would be an object of consideration in this respect; that the cottager, who has a garden and a little property of his own, has always before him *a pleasurable object of industry* for his leisure time: whereas, he who has none, is driven to the alehouse by the same *unhappy neceſsity*, that impels idle young men to the gaming table,—the want of occupation.

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* Landlords and farmers, who wish their own poor's rates reduced, would do well to inquire into the amount of the poor's rates in those parishes, where labourers have gardens and cows. One annual rate of sixpence in the pound has proved fully adequate to the relief of the poor in such a parish. See the Earl of Winchelsea's letter, and some other reports, on the advantages of cottagers renting land.

"In the mode which I suggested to Britton Abbot, of his renting the cow, he would acquire a gradually increasing interest in her, so as to make him anxious for her preservation, but not such as to involve him deeply in case of her death, or to give him a right to dispose of her. In this way, the sum of 15l.†

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* Productive gardens to cottages, would, by the increased consumption of vegetables, make a considerable saving in bread corn; the same observation may be applied to cottagers' cows. Of butter, eggs, and poultry, our markets might have a regular and cheap supply from cottagers.

† Upon supposition that the price of the cow were 12l. the donor of such a fund would have to advance 8l. 10s. the first year, 5l. the second, and 1l. 10s.

would be sufficient to constiute a *perpetual fund*, in any parish, for supplying the *annual premium* of a cow for some industrious and well-disposed labourer, as long as the landlord will consult his own interest, and afford the means of feeding her. Whether this object is to be attained by annexing ground to the cottages, or by letting to the cottager an agistment for his cow, or by supplying him with pasture, and a certain quantity of hay*, at an annual rent: or by making it one of the conditions on which the farmer takes his farm, that he shall keep his cottager's cow at a limited

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the third; after which, the rent of 3l. 10s. paid for three years, for each cow, would produce in future, 10l. 10s. a year; being (with the 3l. 10s. originally paid by the cottager) 2l. more than would purchase a cottager's cow every year after. The additional 2l. a year, would, I presume, be sufficient to insure, for the year, the landlord's interest in the cows.

* Mr. Burdon's cow pastures are closes of sixteen acres, for twelve cows each; he allows each cottager two loads of hay; making the hay in small stacks of four loads each, so that one stack serves two cottagers. He finds the system answer, both as to the improvement of ground, and the amount of rent. I can only say, that, when I was at Castle Eden, I thought his cottagers' hay stacks and cows the most pleasing ornaments of a very beautiful place.

price,—whatever mode is to be adopted, will depend much on the circumstances of the country. There is hardly any part of England, however, in which the cottager's cow may not be provided for, by one or other of these means; or by another mode, which I should prefer, when practicable, as the right which it would give the poor man, would be *unalienable*; and that is, enclosing and improving from the waste*, cow pastures of ten or twelve acres each; the exclusive benefit whereof, the cottagers of the parish should enjoy at a small rent; which, (after providing for fences, &c.) might go as a fund for supplying the poor of the parish with fuel. Such enclosures would be extremely gratifying and beneficial to that useful claſs of men, the labouring poor. The stock on them should be limited; and a preference given to labourers working within the parish, in proportion to their families, their industry, and character.

"I have only to add, that my friend's history contains in it a strong proof, that, though the cottager is benefited by the supply of a garden and of land for his cow, while he continues a *labourer*; yet, if more land is added, just enough to constitute him *a little farmer*, with a very small capital, and to make him forego his profit and advantage as a labourer, his means of life, instead of being improved by the acquisition of land, are prejudiced. No persons earn a harder or more precarious living, or do leſs good with their land, than very small farmers. The condition of a labourer, who has a well-stocked garden, a couple of cows, a pig, and just ground enough to keep them, is affluence, compared with the lot of him, who attempts to live as a farmer, on a small quantity of ground, not sufficient to maintain him as a farmer, though abundantly adequate to its object, if divided among several labourers."

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* This plan has been adopted in the Iver Enclosure Bill now before Parliament. 31*st May*, 1800.

I think I cannot conclude this homely, but interesting eſsay, in a way more consistent with its original design, than by publishing the following Golden Rules, for the use of the labouring cottager and his family.

1. The *ready penny* always fetches the best bargain. He who buys upon trust, must not complain if he is cheated. The shopkeeper

suspects his customer *who buys on trust*, and thinks that he means to cheat, and never to pay; and therefore he takes good care to be beforehand, and charges high accordingly.

2. The best pennyworth is to be had where most sit together, in the open market; and bargains are often cheaper in the latter end of the day. When honest men have done their work, it is better for them to go to market, than to the alehouse.

3. When times are hard, why should we make them harder still? Is it not enough to be taxed once by government, without being taxed twice by folly, thrice by drunkenneſs, four times by lazineſs, and so on?—A good man, even in hard times, will do twice as well, as a bad man will in the best of times. Let us all then rise up *against ourselves*, who thus *tax and injure ourselves:* and we shall soon find that the times will mend. *Let us do good to ourselves at home*, and we shall become happy in our own habitations; and learn that it is a true saying, that "God helps those who help themselves."

4. TIME IS OUR ESTATE; it is our most

valuable property. If we lose it, or waste it, we can never—*never* purchase it back again. We ought, therefore, not to have an idle hour, or throw away an idle penny.—While we employ our time and our property, (however small that property may be) to the best advantage, we shall find that *a fortune may be made in any situation of life;* and that the poor man, who once wanted aſsistance himself, may become able to aſsist and relieve others.

5. INDUSTRY will make a man a purse, and frugality wlll find him strings for it. Neither the purse nor the strings will cost him any thing. He who has it, should only draw the strings as frugality directs; and he will be sure always to find a useful penny at the bottom of it. *The servants of industry* are known by their livery; it is always *whole* and *wholesome.* Idleneſs travels very leisurely, and poverty soon overtakes her. Look at the *ragged slaves of idleneſs,* and judge which is the best master to serve;—Industry, or Idleneſs.

6. MARRIAGE IS HONOURABLE: and the marriage state, when entered into with prudence, and continued in with discretion, is of

all conditions of life the *most happy*; but to bring a wife home, before we have made provision by our industry and prudence, for her and our children, or to choose a wife, who has not, by attention and economy on her part, proved herself fit to manage a family, is *extremely imprudent aud improvident.* Let, therefore, the young prepare themselves for the married state, by treasuring up *all the surplus of their youthful earnings*, and they will marry with confidence, and live together in comfort.

7. Of all *idolatry* that ever debased any savage or ignorant nation, the worship of the *gin bottle* is the most disgraceful. The worshipper becomes unfit for any thing; he soon dries up his liver, and ruins himself and his family.

8. He who does not make his family comfortable, will himself never be happy at home; and he who is not happy at home, will never be happy any where.—Charity begins at home: the husband and wife, who can hardly keep themselves and their children, should not keep a dog to rob the children of part of their food.

9. She who roasts or broils her meat, wastes

half of it in the *fire*. She who boils it, loses much of it in the *steam*. But when the good wife stews her meat gently, thickening the liquor with a little meal, ground rice, or pease and vegetables, and making it savory with fried onions, herbs, and seasoning, her husband and she fare much better, their children thrive and grow hearty and stout, and their money goes twice as far.

10. When you stew or boil your meat, if you leave the veſsel uncovered, a great deal of the best part goes off and is wasted in steam, which never returns.

11. Sinning is a very expensive occupation.—Ask those who have practised it; they can tell you what it has cost them.

12. Sin is the greatest of all evils; the salvation of the soul our best good; and THE GRACE OF GOD our richest treasure. Let the poor man find his way to the cheapest market on Saturday, to a place of divine worship on Sunday, and, like an honest man, go to his labour on Monday. Following these plain directions, he may be *twice happy*; HAPPY HERE, AND HAPPY HEREAFTER.

ESSAY XIV.

Experiments and concise Agricultural Observations.

EVERY person, who, for a series of years, has attended to the progress of agricultural knowledge, must be convinced, that experiment alone is the origin of useful knowledge; that reasoning, without experiment, only bewilders; and that all remarks and observations that do not come in this shape, ought to be received with caution. This being fully admitted, we shall soon see much proud reasoning swept away, and facts alone permitted to have real weight and influence.

1. *On the Direction of Ridges*[*].

In the County of Norfolk, where wheat is universally raised upon narrow lands, they endeavour to lay their ridges North and South, that the sun may have an equal influence on either side of the narrow ridges. In other counties, this circumstance, though very important, is seldom attended to.

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[*] By A. Hunter, M. D.

2. *On Sand used as litter* *.

In many parts of Norfolk, bordering upon the sea, it is the custom to litter their stables with sand instead of straw; as the bed becomes soiled or wet, fresh sand is scattered on, until the whole is in a degree saturated with dung and urine: the stall is then cleaned out, and a fresh bed of sand laid in. By this means, manure, of a quality singularly excellent, is produced, and which is carried by the farmers to a very considerable distance.

3. *To uncover Turnips buried under snow* †.

The instrument used in Norfolk for this purpose, is called a snow sledge. It is, simply, three deal or other boards, from one to two inches thick, ten or twelve inches deep, and seven to nine feet long, set upon their edges in the form of an equilateral triangle, and strongly united with nails, or straps of iron, at the angles, at one of which is fastened, by means of a double strap, a hook or eye, to hang the horses to. This instrument being drawn over a piece of turnips covered with snow, forces up the snow into a ridge, while between the ridges a stripe of turnips is left bare, without having received any material damage from the operation.

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* By Mr. Marshall.

† By Mr, Marshall.

4. *On the management of Seed Barley in a dry season* *.

It is well known that barley is leſs valuable when it does not ripen equally; that barley which comes up speedily in a dusty soil, must gain a great advantage over seed weeds, and that barley which shall come a fortnight or three weeks earlier than others to market, will probably bring a higher price.

Therefore, first take out about one-third of the contents of the sacks of seed barley, to allow for the swelling of the grain. Lay the sacks with the grain to steep in clean water; let it lie covered with it, for at least twenty-four hours. When the ground is very dry, and no likelihood of rain for ten days, it is better to lie thirty-six hours. Sow the grain wet from steeping, without the addition of powdered quick-lime, which, though often recommended, can only poison the seed, suck up part of its uſeful moisture, and burn the hands of the sower. The seed will scatter well, as clean water has no tenacity. The sower should use a fourth, or a third more seed in bulk than usual of dry grain, as the grain is found to swell in that proportion. After sowing, harrow in as quickly as poſsible, and though not neceſsary, give it a fresh furrow if convenient. You may expect the seed to make its appearance in a fortnight at farthest. May 8, my steeped barley, sown on the 10th and 11th of April, is now from four to six inches high; and what was sown on the 19th and 21st of April, on a ley holme, a month ploughed, is this day, or in the space of a fortnight, fairly come up; and the head ridges, especially one that was recently ploughed, though sown on the 25th, is beginning to appear. But the steeped seed running short, my overseer sowed about a rood on the fresh ploughed head-ridge, with unsteeped barley, where not a plant as yet appears; on the contrary, the grain may be found in the soil as dry, hard, and wrinkled on the skin, as when taken from the granery. In this uncommonly dry season, I need not point out other instances of grain much longer sown, not as yet come up. I shall only add, that I have uniformly followed this method for above twelve years with unvaried succeſs.

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* By William Copland, Esq,

5. *On Barn Floors**.

In some of the midland counties, there is practised a peculiar method of laying wooden barn floors: instead of the planks being nailed down to sleepers, in the ordinary way, the floor is first laid with bricks, and the planks spread over those, with no other confinement than that of being pinned together, and their ends let into walls, placed in the usual way, on each side of the floor.

By this method of putting down the planks, provided the brick work be left truly level, vermine cannot have a hiding place beneath them; and a communication of damp air being effectually prevented, floors thus laid are found to wear better than those laid upon sleepers. Planks used for this method of laying, ought to be made of youthful, stout, strong-grained wood, and well seasoned. The bricks used, should be set edgeway upon mortar, and made as firm and level as poſsible.

6. *On Buck-wheat* †.

Buck-wheat prevents the growth of weeds, but will not destroy couch-graſs. It is usually sown in Suffolk with graſs-seeds, for laying down land; and for that purpose it is preferred to most other kinds of spring corn.

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* By Mr. Marshall. † By a Suffolk farmer.

7. *On Steeping Seed Barley in dung water**.

The last spring being remarkably dry, I soaked my seed barley in the black water taken from a reservoir, which constantly receives the draining of my dunghill and stables. As the light corn floated on the top, I skimmed it off, and let the rest stand twenty-four hours. On taking it from the water, I mixed the seed grain with a sufficient quantity of sifted wood ashes, to make it spread regularly, and sowed three fields with it. I began sowing the 16th and finished the 23d of April. The produce was sixty bushels per acre, of good clean barley, without any small or green corn, or weeds at harvest.

I sowed also several other fields with the same seed dry, and without any preparation; but the crop, like those of my neighbours, was very poor; not being more than twenty bushels per acre, and much mixed with green corn and weeds when harvested. I also sowed some of the seed dry on one ridge in each of my former fields, but the produce was poor in comparison of the other parts of the field.

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* By Mr. James Chapple, of Bodmin.

8. *To prevent Butter from being tainted by Cabbages or Turnips*[*].

A small bit of salt-petre, powdered and put into the milk pan with the new milk, effectually prevents the cream and butter from being tainted, although the cows be fed on the refuse leaves of cabbages and turnips. In the beginning of last winter, my men were very careful not to give to the cows any outside, or decayed leaves of the cabbages or turnips, yet the cream and butter were sadly tainted; but as soon as the dairy-maid used the salt-petre, all the taint was done away; and afterwards, no care was taken in feeding the cows, for they had cabbages and turnips in all states. Our milk pans hold about nine pints of milk.

9. *On Salting Hay*[†].

Few farmers are acquainted with the benefit arising from salting hay, particularly when stacked in sultry weather; as the salt preserves the hay from over-heating and becoming mildewed, it may be put together greener than otherwise, without danger of firing. All kinds of cattle &c. prefer inferior hay thus managed, to the best that can be placed before them that has not been salted; the salt aſsimilates with the juices of the hay, and thereby prevents too great a fermentation.— The proper way of using it is, in building the stack, to sprinkle the salt alternately between each layer of hay, in the proportion of one hundred weight to seven or eight tons of hay.

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[*] By J. Jones, Esq.

[†] By Mr. Thomas Barnard.

10 *To eradicate Coltsfoot*[*].

In winter, plough the land. In spring, get it by frequent ploughings in good order for turnips; sow them early, and when the coltsfoot comes up, let it be hand-pulled. By this means the coltsfoot may be entirely eradicated. The expense, about ten shillings per acre.— The coltsfoot having a deep tough root, is very difficult to pull up, but when the land is ploughed deep, and made light, it is easily drawn out.

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[*] By Mr. Thomas Barnard.

11. *On Jerusalem Artichokes*[*].

I find the produce of Jerusalem artichokes to be about three hundred bushels per acre, and I think they are nearly equal in value to potatoes for feeding store pigs, that are not leſs than five or six months old. For fatting hogs, I do not find they are near so valuable as potatoes. But their chief recommendations are, the certainty of the crop, that they will grow in any soil, and that they do not require any manure, at least, for such a produce as I have stated. The Jerusalem artichoke is proof against the severest frost, and may be taken out of the ground as occasion may serve; whereas potatoes are soon affected by frost, and must, therefore, be secured before the winter sets in.

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[*] By Mr. N. Bartley.

12. *A Table for Manuring Land**.

As every husbandman should know the exact distribution of his manure, I have constructed the following table for his use:

No. of heaps to a load	1	2	3	4	5	6	7	8
At 5 yards distance	193	96	64	48	38	32	27	24
At 5½ yards	160	80	53	40	32	26	23	20
At 6 yards	134	67	44	33	26	22	19	16
At 6½ yards	114	57	38	28	22	19	16	14
At 7 yards	98	49	32	24	19	16	14	12
At 7½ yards	86	43	28	21	17	14	12	10
At 8 yards	75	37	25	18	15	12	10	9

Number of Loads to an Acre.

Explanation of the first two Rows of Figures.

The number of heaps of one load each, laid at five yards distance, is 193 to cover an acre—2 heaps to a load, 96—3 heaps, 64, and so to the end. Each of the succeeding rows of figures to be read in the same manner.

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* By the Rev. H. J. Close.

13. *To destroy Ant-hills*[*].

With a common spade, ground sharp, divide the hills into four quarters. With the same instrument, pare off the sward of the quarters, an inch or two thick, leaving the triangular turves pared off fast at their base, folding them back upon the adjoining sward. This done, dig out the core of the hill, chopping and spreading the mould abroad, and leaving a hollow bason where the hill stood, in order to collect the winter's rains, and thereby effect a radical cure. Return the folds of swards as a cover to the excavation, leaving the surface graſsy and nearly level, so as not to be discernable from the surrounding sward. Between Michaelmas and Christmas is the proper time for performing this operation; for then the excavated mould becomes tempered by the winter's rains and frosts; and the folds of sward have time to unite with the soil before the summer's drought sets in.

14. *On chopping Stubbles*[†].

All good farmers chop their stubbles soon after harvest, and convey them to the fold yard, to be trod into manure. When the stubble is left upon the land, it is entirely lost as a manure. Besides, it prevents the plough from turning in the land with neatneſs. In those parts of the kingdom where the ſtubble is removed into the fold yard, the price for chopping and raking into heaps is, from one ſhilling and ſixpence to two ſhilling per acre; a triffling expenſe when compared with the advantages that ariſe from the operation.

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[*] By Mr. Marshall.

[†] By A. Hunter, M. D.

16. *On Weeds* *.

Wherever abundance of thiſtles, nettles, and other weeds, are obſerved in the roads and lanes, we may pronounce that much bad farming exiſts in the neighbourhood. Theſe ſhould be cut down before they perfect their ſeed, and carried off to the fold yard, or burnt into aſhes. The price of manure being now ſo much increaſed, it is matter of ſurpriſe that this practice is ſo little attended to, eſpecially as it effectually prevents the diſſemination of the numerous tribe of winged ſeeds, that occaſion ſo much trouble to the farmer.

It is a pleaſing circumſtance to obſerve the feeble hands of every village, now buſily em-

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* By A. Hunter, M. D.

17 *On Sea-weed*[*].

Near the sea-coast of the County of Norfolk, great quantities of sea-weed, or ouze, are collected by the intelligent farmers, for the purpose of increasing the size of their compost dunghills. It is mixed with earth and lime, or marl and dung, for one year, and then laid on arable land. The industrious and provident farmer can be placed in no situation where he cannot obtain something for the enlargement of his manure heap, without applying immediately to his stable, or fold-yard. An attention to this provident branch of husbandry cannot be recommended in too forcible terms. It is a warm expreſsion, but I think a just one, that no farmer ought to spit upon any man's land but his own.

18. *On Turnips*[†].

The farmers in Norfolk, continue sowing turnips from midsummer to the latter end of August, by which means their late crops remain good till the latter end of April, and often to the middle of May. Those late sown turnips are always of a diminutive size, so they should be allowed to stand thicker upon the ground, to make up in number what is wanting in weight. The best farmers sow their turnips in drills, three feet asunder, and at a second hoeing leave them a foot asunder in the rows. The intervals must in this mode of cultivation be carefully horse-hoed. An acre of land contains 4,840 square yards, or 43,560 square feet. Suppose every square foot, under the broad-cast management, to contain one turnip, and that they only weigh two pounds each, on an average, the land will produce forty-six tons per acre. In dry seasons, broad-cast turnips should be sown as soon as poſsible after the plough, in order that the seed may be placed upon a moist bed; a consideration of great consequence.

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[*] By A. Hunter, M. D.

[†] By A. Hunter, M. D.

19. *On Carrot Hay* *.

On the authority of the ingenious Mr. Monk, author of the Liecestershire Survey, we are told, that a gentleman of respectable character in that county, is used to cut off the tops of carrots in the month of July, for the purpose of making them into hay, the trouble of making being little more than what is bestowed upon clover. A good acre of carrots, we are told, will make four tons of excellent hay, very acceptable to all kinds of cattle.— After this operation, the carrots soon put out fresh leaves, which bring the roots forward without diminishing their size. However singular this experiment may appear, it is given to the public under respectable authority.

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* By A. Hunter, M. D.

20. *To Destroy Moſs* *.

When old sward becomes infected with moſs, let it be well harrowed, and afterwards manured and bush-harrowed. But even without manuring, the land will be greatly benefited by the operation.

21 *To preserve Carrots from the Frost* †.

The carrots being taken up, and their tops (which are given to cattle, &c) cut off, let them be placed as close to each other (perpendicular) as poſsible in a trench. When the trench is full, cover them over with straw, and over the straw return the mould that was taken out of the trench. Carrots so preserved, keep better than when put into sand.

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* By J. Monk, Esq.

† By J. Monk, Esq.

22. *On Capons*[*].

As Gentlemen of landed property have lately ſhown a diſpoſition to increaſe the comforts of the cottager, I flatter myſelf that the following obſervations will be the means of reviving a practice that may be profitably undertaken by the families of thoſe perſons who rank as cottagers.

Horſham, in Suſſex, is the great emporium of Capons. They are there fattened to an extent unknown in other places. When fully fed, they often exceed nine pounds in weight. Their food conſiſts of barley-meal, milk, and the ſkimmings of the pot, that is ſomething which is greaſy; but for the finiſhing, they depend on ſweet and good molaſſes. In the northern parts of this iſland, the practice of making capons was formerly well underſtood in almoſt every village, but the art is nearly loſt; a very ſingular circumſtance in an age of unbounded luxury.

23 *On paring and burning for Graſs* †.

A few years ago a Gentleman pared and

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[*] By A. Hunter, M. D.

† By A. Young, Esq.

burned a poor worn-out lay; spread the ashes, and harrowed in white clover, rye-graſs, rib-graſs, and trefoil, without any ploughing. The land has ever since been a very fine meadow. This is a remarkable experiment that deserves much attention, for it is applicable to cases in which such management would prove uncommonly convenient. It is, where suitable, the cheapest of all improvements. How unfortunate it is for the theoretical enemies of paring and burning, that no year paſses in which fresh facts do not appear which prove it to be the most admirable of all practices!

24. *On River or Pond-Weed*[*].

I have found, from experience, that river, or pond-weed, is a most excellent manure for turnips. At this time I have part of two pieces of turnips, for which I put on about twelve loads per acre of fresh, green, river weeds, and which are fully equal, or, if any difference, rather superior to the turnips in the other parts of the closes, and which were dressed with an equal quantity of common dung

Where land, destined for the turnip crop, is situated near a stream abounding with the vegetables which usually grow in such situations, the cultivator is highly to blame if he does not avail himself of the means thus offered of fertilizing his land.

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[*] By a Norfolk Farmer.

The usual method of procuring the weed is to make a staunch or dam acroſs the stream, by means of a strong rope made fast to stakes on either side, with the aſsistance of hurdles, or other stakes, driven into the bottom of the river, the more effectually to stop the weeds as they float down the stream after cutting. The dam being fixed, the weeds are next to be cut; the most effectual instrument for which is a long chain, if I may so term it, of scythes, formed so as to take any neceſsary curve. This instrument is drawn by a man on either side the stream, who pulls alternately, by which means the weeds are cut effectually and expeditiously. As soon as a sufficient quantity are collected on the dam, they are drawn out by crombes, forks, &c. and thrown into a heap, from which they may be immediately carried on to the land, and let down in heaps of a similar size, and at an equal distance, as is observed in setting on dung. That they may be spread with the greatest evenneſs, one man, with the blade of a scythe, cuts a slice from the side of the heap, of about six or eight inches in thickneſs, whilst others load the weeds thus cut on the carts. In this manner the busineſs goes forward; some drawing the weeds from the river, another cutting the heaps, the rest loading, &c.

That the above answers extremely well as a manure, I can say not only from my own observation, but from the constant practice of some of the best farmers in the county of Norfolk. Mr. Coke, I believe, constantly manures a considerable quantity of land for turnips with the weeds collected from the lake at Holkham.

On Carrots[*].

Last spring I sowed, broadcast, two acres of carrots, following a potatoe crop, on a light sandy loam of twenty shillings an acre. They were twice hoed at thirteen shillings the two acres, in the manner of hoeing turnips; and in the course of the summer, I mowed one-third of the tops twice; another third of the tops I mowed once, and the remaining third of the crop the scythe did not paſs over. The tops were greedily devoured by my horses, cattle, and pigs, in the fold-yard; and were equal in quantity and value to a considerable crop of clover, cut and made use of in the same mode.

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[*] By Sir Henry Vavasour, Bart.

At the end of October, I took up the carrot roots, and preserved them in a trench in the manner of potatoes. The crop was full six hundred bushels per acre; and it was not found that the roots of those carrots, whose tops had been twice cut, were at all inferior, in size or quality, to those whose tops had been left untouched. A paſsage was left for a small cart to carry off the tops, and another I made by drawing the young carrots for family use.

I have reason to consider this mode of cultivating carrots, equal to the best fallow crop, provided the carrots are twice well hoed, and the tops are cut off, as the scythe prevents any weeds seeding in the autumn.

My horses, oxen, milch cows, and pigs, are at this time eating the carrot roots; my turkies and other poultry, have them boiled, and are fatted well upon them; even my pigeons are fatted upon carrots, as they constantly attend in the fold-yard, to pick up every particle that drops from the mouths of the cattle; which supply is sufficient to keep my pigeons at home, and to save an expense in feeding them during the severe weather.

The market price for carrots, near my home, twelve miles east of York, is from tenpence to one shilling per bushel, at which price, it must be allowed, that the crop is a profitable one.

I must observe, that the demand for carrots, in this neighbourhood, is not inconsiderable, for stallions; for it is found that this food is more invigorating and fattening than any other that can be given to them.

26. *On Dibbling Wheat*[*].

Wheat is generally planted on a clover lay, and if the land be very light, it should be ploughed a week or ten days before planted; and should a good rain fall, it will be advantageous, because the holes will stand open the better to receive the seed, and the ground will not rise so much when bush-harrowed: In heavier land, the plough should receive the dibblers only a day or two, and be planted in the earliest part of the season, which should be particularly observed, as heavy land, after much rain, cannot be dibbled.

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[*] By David Barclay, Esq.

Plough the land from three to four inches deep, and nine inches wide, and make about eighteen furrows on one ridge of land, about five yards wide; but when the soil is very dry, the ridge may be double the breadth. Let a man follow the plough with a spade, and level the flag, where it may have been broken by the plough; then roll it with a roller of about seven feet, with one or two horses, or oxen, and it is fit for dibbling. A man or a woman has a dibble in each hand, about two feet nine inches long, made of iron, the bottom of which is made in the form of a cone, suitable to make a hole in the ground not leſs than two inches deep, and the handle is covered with wood for the ease of the dibbler, who walks backward, and turning the dibbles partly round, (which must be particularly observed, because that action prevents the mould from falling into the hole) makes two holes on each flag, at the distance of three inches the length way of the flag. Children follow, and drop in two or three seeds, and care should be taken that they do not drop in more: two at the beginning of the season would be sufficient, and three at the latter end. The land should be bush-harrowed three or four times in a place, the same day, by the farmer, with bushes fixed to a gate-lift, or if on light harrows, care must be taken that the tines do not penetrate the ground. Seven pecks of wheat prepared as usual, are sufficient for an acre. One dibbler generally undertakes the buſineſs of one gang, after the ground is plowed and rolled, at 9s.; 9s. 6d.; 10s. or 10s. 6d. per acre. He hires other dibblers, women at one shilling per day, or men according to their abilities, (women generally do two-thirds of the work of a man) and children at seven or eight year old, at threepence halfpenny per day, who follow the dibbler, and drop the wheat into one row of the holes: Children, ten or twelve years old, drop into two rows, and receive sevenpence per day. An active dibbler, used to the buſineſs, with three droppers at sevenpence per day, can plant nearly half an acre, if the soil be favourable, and the weather permit. Land in good heart, which had been well manured for turnips, hoed and fed off, and sown with barley and graſs-seeds, which have continued in graſs a year or two, is considered not to want manure: but if otherwise, it may be manured at the rate of fifteen loads an acre, either before it is ploughed, or after it is planted; if the former, plough not more than three inches deep, and if the latter, the manure should be carried on in a frost, or the land may be folded with sheep, which is preferable, on account of not carting upon the land.

Pease and beans are likewise dibbled, and one only put into a hole; the holes for pease are two on a flag, three inches and a half distant length ways; for beans, only one hole in the middle of the flag, and five or six inches distant. The price of dibbling pease seven shillings, and beans four shillings and sixpence per acre.

ESSAY XV.

On the Preparation, Culture, and Use of the Orchis Root.

SALEP is a preparation of the root of Orchis, or Dogstones, of which many species are enumerated by botanical writers. The *Orchis mascula Linn. sp. pl.* is the most valued, although the roots of some of the palmated sorts, particularly of the *Orchis Latifolia*, are found to answer almost equally well. This plant flourishes in various parts of Europe and Aſia, and grows in our country spontaneously, and in great abundance. It is aſsiduously cultivated in the East; and the root of it forms a considerable part of the diet of the inhabitants of Turkey, Persia, and Syria. A dry, and not very fertile soil is best adapted to its growth. An ingenious friend of mine, in order to collect the seed, transplanted a number of the Orchises into a meadow, where he had prepared a bed well manured for their reception. The next spring few of them appeared, and not one came to maturity, their roots being black and half rotten. The same gentleman informed me that he had never been able to raiſe any plants from the seed of the wild Orchis; but he ascribes his want of succeſs to the wetneſs of the situation in which he resides. I have now before me a seed pod of the Orchis, the contents of which, to the naked eye, seem to be seed corrupted and turned to dust; but, when viewed through a microscope, appear evidently to be organized, and would, I doubt not, with proper culture, germinate, and produce a thriving crop of plants. The properest time for gathering the roots is when the seed is formed, and the stalk is ready to fall, because the new bulb, of which the salep is made, is then arrived to its full maturity, and may be distinguished from the old one, by a white bud rising from the top of it, which is the germ of the Orchis of the succeeding year.

Several methods of preparing salep have been proposed and practised. Geoffroy has delivered a very judicious proceſs, for this purpose, in the *Histoire de l'Academie Royale des Sciences*, 1740; and Retzius, in the Swedish Transactions, 1764, has improved Geoffroy's method. But Mr. Moult, of Rochdale, has lately favoured the public with a new manner of curing the Orchis root; and as I have seen many specimens of his salep, at least equal, if not superior, to any brought from the Levant, I can recommend the following, which is his proceſs, from my own knowledge of its ſucceſs. The new root is to be washed in water, and the fine brown skin which covers it, is to be separated by means of a small brush, or by dipping the root in hot water, and rubbing it with a coarse linen cloth. When a sufficient number of roots have been thus cleaned, they are to be spread on a tin-plate, and placed in an oven heated to the usual degree, where they are to remain six or ten minutes, in which time they will have lost their milky whiteneſs, and acquired a transparency like horn, without any diminution of bulk. Being arrived at this state, they are to be removed, in order to dry and harden in the air, which will require several days to effect; or, by using a very gentle heat, they may be finished in a few hours*.

Salep, thus prepared, may be afforded, in this part of England, where labour bears a high value, at about 8d. or 10d. per lb. And it might be sold still cheaper, if the Orchis were to be cured without separating from it the brown skin which covers it;—a troublesome part of the proceſs, and which does not contribute to render the root either more palatable or salutary. Whereas the foreign Salep is now sold at 5s. or 6s. per lb.

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* Vid. A Letter from Mr. John Moult to the Author, containing a new method of preparing Salep.——Phil. Transact. vol. 59.

The culture of the Orchis, therefore, is an object highly deserving of encouragement from all the lovers of agriculture. And as the root, if introduced into common use, would furnish a cheap, wholesome, and most nutritious article of diet, the growth of it would be sufficiently profitable to the farmer.

Salep is said to contain the greatest quantity of vegetable nourishment in the smallest bulk. Hence a very judicious writer, to prevent the dreadful calamity of famine at sea, has lately proposed that the powder of it should constitute part of the provisions of every ship's company. This powder and portable soup, dissolved in boiling water, form a rich thick jelly, capable of ſupporting life for a considerable length of time. An ounce of each of these articles, with two quarts of boiling water, will be sufficient subsistence for a man a day [*]; and, as being a mixture of animal and vegetable food, must prove more nourishing than double the quantity of rice-cake, made by boiling rice in water. This last, however, sailors are often obliged solely to subsist upon for several months, especially in voyages to Guinea, when the bread and flour are exhausted, and the beef and pork, having been salted in hot countries, are become unfit for use [†].

But, as a wholesome nourishment, rice is much inferior to salep. I digested several alimentary mixtures prepared of mutton and water, beat up with bread, sea-biscuit, salep, rice-flour, sago-powder, potatoe, old cheese, &c. in a heat equal to that of the human body. In forty-eight hours they had all acquired a vinous smell, and were in brisk fermentation, except the mixture with rice, which did not emit many air bubbles, and was but little changed. The third day several of the mixtures were sweet, and continued to ferment; others had lost their intestine motion, and were sour; but the one which contained the rice was become putrid. From this experiment it appears that rice, as an aliment, is slow of fermentation, and a very weak corrector of putrefaction. It is therefore an improper diet for hospital patients; but more particularly for sailors, in long voyages, because it is incapable of preventing, and will not contribute much to check the progreſs of that fatal disease, the sea-scurvy*. Under certain circumstances, rice seems disposed of itself, without mixture, to become putrid; for by long keeping, it sometimes acquires an offensive fœtor; nor can it be considered as a very nutritive kind of food, on account of its difficult solubility in the stomach. Experience confirms the truth of this conclusion:. For it is observed by the planters in the West Indies, that the negroes grow thin, and are leſs able to work whilst they subsist upon rice.

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[*] Portable soup is sold at 2s. 6d. per lb.; salep, if cultivated in our own country, might be afforded at 10d. per lb.; the day's subsistence would therefore amount only to 2½d.

[†] Vide Dr. Lind's Appendix to his Eſsay on the Diseases of Hot Climates.

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* Cheese is now become a considerable article of ship provisions. When mellowed by age, it ferments readily with flesh and water, but separates a rancid oil, which seems incapable of any further change, and must, as a septic, be pernicious in the scurvy; for rancidity appears to be a species of putrefaction. The same objection may be urged, with still greater propriety, against the use of cheese in hospitals; because convalscents are so liable to relapses, that the slightest error of diet may occasion them. Vide Percival's Letter to Mr. Aikin.—Thoughts on Hospitals, p. 95.

Salep has the singular property of concealing the taste of salt-water *; a circumstance of the highest importance at sea, when there is a scarcity of fresh water. I desolved a drachm and a half of common salt in a pint of the mucilage of salep, so liquid as to be potable, and the same quantity in a pint of spring water. The salep was by no means disagreeable to the taste, but the water was rendered extremely unpalatable.

This experiment suggested to me the trial of the Orchis-root as a corrector of acidity; a property which would render it a very useful diet for children. But the solution of it, when mixed with vinegar, seemed only to dilute, like an equal proportion of water, and not to cover its sharpneſs.

Salep, however, appears by my experi-

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* Vide Dr. Lind's Appendix.

ments, to retard the acetous fermentation of milk, and consequently would be a good lithing for milk pottage, especially in large towns, where the cattle, being fed upon sour draff must yield acescent milk.

Salep, in a certain proportion, which I have not yet been able to ascertain, would be a very useful and profitable addition to bread. I directed one ounce of the powder to be dissolved in a quart of water, and the mucilage to be mixed with a sufficient quantity of flour, salt, and yeast. The flour amounted to two pounds, the yeast to two ounces, and the salt to eighty grains. The loaf when baked was remarkably well fermented, and weighed three pounds two ounces. Another, loaf made with the same quantity of flour, &c. weighed two pounds and twelve ounces: from which it appears that the Salep, though used in so small a proportion, increased the gravity of the loaf six ounces, by absorbing and retaining more water than the flour alone was capable of. Half a pound of flour and an ounce of salep were mixed together, and the water added according to the usual method of preparing bread. The loaf, when baked, weighed thirteen ounces and a half; and would probably have been heavier, if the Salep had been previously diſsolved in about a pint of water. But it should be remarked, that the quantity of flour used in this trial, was not sufficient to conceal the peculiar taste of the Salep.

The restorative, mucilaginous, and demulcent qualities of the Orchis-root render it of considerable use in various diseases. In the sea-scurvy it powerfully obtunds the acrimony of the fluids, and at the same time is easily aſſimulated into a mild and nutritious chyle. In diarrhœas and the dysentery, it is highly serviceable, by sheathing the internal coat of the intestines, by abating irritation, and gently correcting putrefaction. In the symptomatic fever, which arises from the absorption of pus, from ulcers in the lungs, from wounds, or from amputation, Salep, used plentifully, is an admirable demulcent, and well adapted to resit that diſsolution of the crasis of the blood, which is so evident in these cases. And by the same mucilaginous quality, it is equally efficacious in the strangury and dysury; especially in the latter, when arising from a venereal cause; because the discharge of urine is then attended with the most exquisite pain, from the ulcerations about the neck of the bladder, and through the course of the urethra. I have found it also an useful aliment for patients who labour under the stone or gravel[*].

From these observations; short and imperfect as they are, I hope it will sufficiently appear that the culture of the Orchis root is an object of considerable importance to the public, and highly worthy of encouragement from all the patrons of agriculture. That taste for experiment, which characterises the present age, and which has so amazingly enlarged the boundaries of science, now animates the RATIONAL FARMER, who fears not to deviate from the beaten tract whenever improvements are suggested, or useful projects are pointed out to him. Much has been already done for the advancement of agriculture; but the earth still teems with treasures which remain to be explored. The bounties of Nature are inexhaustible, and will for ever employ the art, and reward the industry of man.

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[*] The ancient chymists seem to have entertained a a very high opinion of the virtues of theOrchis root, of which the following quotation from the SECRETA SECRETORUM of Raymund Lully, affords a diverting proof. The work is dated 1565.

SEXTA HERBA,

Satirion.

"Satirion herba est pluribus nota, hujus radicis collecta ad pondus lib. 4. die 20 mensis Januarij, contunde fortiter et maſsam contusam pone in ollam de aurichalco habente in cooperculo 20 foramina minuta sicut athomi, & pone intus cù prædicta meſsa lactis vaccini calidi sicut mulgetur de vacca ℔. 3. & mellis libram 1. vini aromatici ℔. 2. & repone per dies 20. ad solem & conserva & utere."

"Istius itaq; dosis ad pondus 3. 4. & hora diei decima exhibita mulieri post ipsius menstrua eadem nocte còcipiet si vir cum ea agat."

ESSAY XVI.

On the Thrashing Machine.

NOTHING has hitherto caused so much loſs and vexation to the farmer, as the proceſs of separating the corn from the straw; and various methods have, in different ages, been adopted for accomplishing this operation. The ancient inhabitants of Asia and Egypt, where agriculture is supposed to have had its origin, knew no other method than that of enclosing a spot in the open air, and smoothing it with clay, rolled hard; this was the thrashing-floor. The corn being next spread in sheaves, oxen were turned in, and kept in motion till the business was done. "Thou shalt not muzzle the ox that treadeth out the corn." Deut. xxv. 4.

If Ælian may be believed, the Greeks were neither so merciful nor cleanly in this circumstance. They besmeared the mouths of the poor animals with dung, to keep them from tasting the corn under their feet. Hiſt. Animal. L. iv. cap. 25.

Machines were next invented, in different countries, made of planks or beams, stuck over with flints or hard pegs, to rub the ears between them; others to bruize out the grain by sledges or trail carts.

> Dicendum et quæ sint duris agrestibus Arma
> Tribula, trabæque, et iniquo pondere rastri.

The translators of Virgil, from Father Ogilvie downwards, have included the flail in this desrciption:

> The Sled, the Tumbril, Hurdles, and the Flail.
> DRYDEN.

Tribulum, however, was certainly the machine first described for the single purpose of separating the grain from the husk or chaff. At what period of time the flail took place of the former awkward machine, is not known with certainty. President Goguet says, that the Turks and many of the Italians have not yet adopted it. The barbarous Celts, accustomed to fire and sword, made short work. They burned the straw, and instantly devoured the grain; and it is said this custom continues in some parts of the Highlands of Scotland to this day.

In Britain, till within these twenty years, the flail may be said to have been the only instrument employed for thrashing corn; but previous to that period, several attempts were made to construct machines for performing that laborious work. The first attempt was made by an ingenious gentleman of the county of East Lothian, Mr. Michael Menzies, who invented a machine that was to go by water, upon the principle of driving a number of flails by a water-wheel; but from the force with which they wrought, the flails were soon broken to pieces, and consequently the invention did not succeed.

Another thrashing machine was invented about 1758 by Mr. Michael Stirling, a farmer in the parish of Dumblain, Perthshire. This machine was nearly the same as the common mill for dreſsing flax, being a vertical shaft with four croſs arms, inclosed in a cylindrical case, three feet and a half high, and eight feet diameter. Within this case, the shaft with its arms, were turned with considerable velocity by a water-wheel, and the sheaves of corn being let down gradually, through an opening for the purpose on the top of the box, the grain was beat off by the arms, and preſsed with the straw through an opening in the floor, from which it was separated by riddles shaken by the mill, and then cleared by fanners, also turned by it. The great defect of this machine was, that it broke off the ears of barley or wheat, instead of beating out the grain, and was only fit for oats.

Several other machines were afterwards invented by different persons, for accomplishing this important operation, but none of them answered the purpose, till one was constructed by Mr. Andrew Meikle, at Houston-Mill, near Haddington, Scotland, whose family poſseſs a kind of hereditary right to genius and invention.—Mr. Meikle, who for several years, had been attempting to bring these machines to perfection, ascertained, after much investigation, that they had all been constructed upon wrong principles, and that *beating* must be had recourse to instead, of *rubbing*, otherwise the work could not be performed in a sufficient manner. He therefore, in 1785, made a working model, turned by water, at Know-Mill, in which the grain was *beat out by the drum, after paſsing through two plain rollers*, which were afterwards altered for two *fluted* ones. Mr. George Meikle, son of the former, being at Kilbegie, the residence of Mr. Stein, agreed, to erect a machine of this nature for that gentleman, upon condition of Mr. Stein furnishing all the materials, and paying him for the work, *only in case the machine answered the desired purpose.* This was agreed to, and the machine was completed in February, 1786, being the first of the kind ever made. It was found to work exceedingly well, and the only alteration made from the above mentioned model was, that instead of plain rollers, fluted ones were substituted. In consequence of this succeſsful attempt, a patent for the invention was applied for, which, after a considerable opposition, from a person no ways concerned in the invention, was obtained in April, 1788.

Since the erection of this machine, Mr. Meikle has progreſsively introduced a variety of improvements, all tending to simplify the labour, and to augment the quantity of the work thereby performed. When first erected, though the corn was equally well separated from the straw, yet, as the whole of the straw, chaff and corn, were indiscriminately thrown into a confused heap, the work could only with propriety be considered as half executed. By the addition of rakes or shakers, and two pair of fanners, all drove by the same machinery, the different proceſses of thrashing, shaking, and winnowing, are now all at once performed, and the corn immediately prepared for the public market. When I add, that the quantity of corn gained from the superior powers of the machine is fully equal to a twentieth part of the crop, and that, in some cases, the expense of thrashing and cleaning the corn is considerably leſs than what was formerly paid for cleaning it alone, the immense savings, arising from the invention, will at once be seen.

Where farms are of small size, it would be improper to recommend the erection of large machines, as the interest of the original purchase would be a heavy drawback from the advantages; but under contrary circumstances, I am decidedly of opinion, that a machine of great powers, provided with two rakes or shakers, and two pair of fanners, is the most profitable one for the poſseſsor. By a machine of this kind, when wrought by horses, the grain is completely thrashed and cleaned at little more expense than is paid for cleaning it alone when thrashed by the flail, independent of the additional quantity of corn produced by the powers of the machine; and when wind and water is substituted instead of horses, the saving is considerably increased.

A horse-machine of the greatest powers, with the appendages of rakes and fanners, may be erected for one hundred pounds, and when wrought by wind, for two hundred pounds, independent of the buildings and fixtures which are required. It would be unfair, however, to charge these to the account of the thrashing machine, as even upon a middle-sized farm a greater extent of building is required for barn-work, when the corn is separated from the straw by the flail, than when the operation is performed by the thrashing machine.

From the most minute attention bestowed on this subject, I am confident, an extra quantity of corn, equal, in ordinary years, to 5l. per cent. will be given by the thrashing machine more than by the flail; besides innumerable other advantages which accompany that machine. Indeed the loſs by the flail has long been proverbial, and the best of farmers were obliged to submit to loſses of this nature, because they could not be remedied;—but with the thrashing machine no corn need be lost, as every particle of grain is scutched off, when the machine is constructed upon right principles.

The expense of horse-labour, from the increased value of the animal, and the charge of his keeping, being an object of great importance, I beg leave to recommend, that upon all sizeable farms, that is to say, where two hundred acres, or upwards, of corn are sown, the machine should be wrought by wind, unleſs where local circumstances afford the conveniency of water.

Wind machines were, till lately, exposed to dangerous accidents, as the sails could not be shifted when a brisk gale suddenly arose, which is often the case in the variable climate of North Britain. These disagreeable circumstances are now effectually prevented, by the inventive genius of Mr. Meikle, and the machine may be managed by any person of the smallest discernment, or attention.

The whole sails can be taken in, or let out, in half a minute, as the wind requires, by a person pulling a rope within the house, so that an uniform motion is preserved to the machine, and the danger from sudden squalls prevented.

Where coals are plenty and cheap, steam may be advantageously used for working the machine. A respectable farmer in the County of East Lothian, works his machine in this way, and being situated in the neighbourhood of a colliery, is enabled to thrash his grain at a trifling expense.

The quantity of grain thrashed in a given time, must depend upon its quality, on the length of the straw, and upon the number of horses, or strength of the wind by which the machine is wrought; but under favourable circumstances, from seventy to eighty bushels of oats, and from thirty to fifty bushels of wheat, may be thrashed and cleaned in one hour; but it is from clean dry grain only that so much will be done in that period.

In a word, the thrashing machine is of the greatest utility to the farmer; and from it the public derives a vast additional quantity of food for man and beast. If five per cent. is added to the national produce, it is as great a gain to the public as if the national territories were increased one-seventh more than their present size: for this additional produce is gained without any other expense than the money laid out in erecting the machines; no more seed is sown than formerly, nor more labour employed, and these articles have always been estimated as equal to two-fifths of the produce.

As a farmer's capital ought never to be laid out in expensive building, or works of an extraordinary kind, I am of opinion, that the sums neceſsary for erecting machines, should, in the first instance, be expended by the landlord, and the tenant bound to leave them in a *workable condition* at his departure. Many farmers have capitals sufficient for undertakings of this kind, but the great body of that profeſsion would be injured by such an expense, as they would thereby be deprived of the means of improving their farms in other respects. Besides, as every improvement, at the long run, centres in the pocket of the proprietor, it is but fair and reasonable he should contribute his moiety of the expense laid out in procuring it; and in many cases he would be benefited in the first instance by the erection of thrashing machines; particularly where new farm-steadings are to be built, as fewer buildings would of course be neceſsary.

I shall now offer some calculations relative to the probable amount of the savings, which might accrue to the public, if thrashing machines were universally used. I do not affect to be accurate in these calculations, which cannot be expected before facts are sufficiently ascertained; but to borrow the words, very properly used by the president in his speech to the Board of Agriculture, July 29, 1794, " to be enabled to form some general idea of the nature and extent of public improvement, is a great step gained."

The extent of ground, annually employed in Great Britain, in the raising of corn, may be computed at seven millions five hundred thousand acres, and the average produce of the different grains, at three quarters per acre, as below that increase no farmer can raise it with profit. I observe, in the President's speech to Parliament, when he moved the establishment of the Board, that he supposed there were only five millions of acres annually employed in raising of grain: but I have reason to think this is a mistake; for if the population of the island be ten millions, the produce of these acres would be far below what is required for the support of that number of people, independent of what is neceſsary for the feeding of horses, and sowing the next crop. I observe, also, in the reprinted survey of the county of Stafford, a pretty just calculation of the number of acres annually sown in that county, amounting to one hundred and fifty thousand acres. Now, as Stafford is not a corn county, I do not take much latitude when I fix upon it to average the whole counties of England; this would make the total quantity sown in that kingdom amount to six millions of acres. The remaining one million five hundred thousand acres I suppose to be sown in Scotland and Wales, which makes their produce only equal to that of ten English counties.

If seven millions five hundred thousand acres be annually sown in Britain, and the average produce amount to three quarters per acre, then the total quantity of grain annually raised in Britain would be twenty-two millions five hundred thousand quarters.

I have already said, that the thrashing machine, from its superior powers, will give one twentieth more grain than when the operation of thrashing is performed by the flail: this furnishes an increased quantity of one million one hundred and twelve thousand five hundred quarters; which, taken at the average price of thirty-two shillings per quarter for all grains, amounts to 1,781,250l. Add to this the difference of expense between thrashing with the above machine and the flail, which may be stated at 1s. per quarter; although when the machines are wrought by wind or water, the difference is more than double that sum. This on 22,500,000 quarters, is 1,125,000l.; the whole amounting to 2,906,250l.

I scarce expect to be credited when I say that the above enormous sum would annually be saved to the public, if the *whole* corn raised in Britain was separated from the straw by these machines, and yet few political calculations will admit of such certain demonstration. Let me only suppose that one eighth of our corn is threshed in that way, and still the saving is immense. If any person doubts the principles upon which these calculations are built, I have only to request he would pay strict attention to the subject, and I am pretty positive he will soon acknowledge they are not over stretched. The only deduction neceſsary to be made, is for the interest of the money expended in erecting the machines; the principal sum of which, especially upon large farms, will be repaid by the savings of three years crops.

In a word, I consider the invention of this implement, as the greatest improvement that has been introduced into Britain during the present age. The toil of human labour is thereby leſsened—the stock of agricultural produce is greatly increased, and the facility of managing large concerns mightily promoted. The duty of rewarding the inventor, is a debt incumbent upon the whole landed interest of the Island, and by discharging it, they will stimulate ingenious mechanics, of all descriptions, to exert their talents in making useful discoveries.

ESSAY XVII.

On the Means of extending the Cultivation of Corn on Strong Lands, without diminishing their Value, or leſsening the Production of Animal Food.

THAT farm, it is obvious, is the best managed, which yields the greatest produce at the least expense. And it may be laid down as an axiom, that no farm, which has its resources only within itself, can yield the produce that a tillage-farm will, on which the crops are so judiciously diversified, as to keep such a stock of cattle as shall supply it with manure. A farm, so conducted, may be made not only to produce plentiful crops of corn, but actually to support as large, and in many cases larger, stocks of cattle, than the same compaſs of ground would have done, were the whole to have been in graſs. And this is the true point of view in which agriculture should be looked at, both by landlord and tenant; as holding out to the one the prospect of increaſing profit; to the other that of an improving income. To this point also, as an object of political economy, should every legislative regulation and encouragement, if they ever interfere, be directed.

At present too much land is exclusively appropriated to pasture. In consequence of which, other causes also co-operating, grain has gradually been increasing in value, and is now becoming alarmingly scarce. Were a contrary system, however, not judiciously conducted, to take place, there would then be a deficiency of animal food; a deficiency which, from the prevailing habits of life, would be equally diſtreſsing; and, indeed, more so, as it could with more difficulty be supplied.

Happily for the community, in this instance, as well as in most others, private interest coincides with public duty; though prejudice too frequently prevents the coincidence from being noticed.

An indiscriminate use of the plough is, however, by no means recommended: the strong feeding lands, such as will fatten an ox of seventy, or even sixty stone (fourteen pounds to the stone) per acre, ought rarely to be meddled with; neither should the superior kinds of meadow land, nor land subject to inundation, or which, from its relative situation, admits not of complete drainage; as such land, in winter time particularly, must be frequently inacceſsible. There are other lands also, which, from their incorrigible barrenneſs, will never repay the expense of tillage. There is no danger, however, of any practical farmer wishing to disturb them.

Respecting those lands which are proper for turnips, the mutual advantage, both to landlord and tenant, in occasionally subjecting them to the plough, is so obvious, and at the same time so well understood, that it would be superfluous to insist upon it. And yet I have been told, and by a gentleman too of the first agricultural information in the kingdom, that there are at this day, innumerable sheep-walks, both in Suffolk and Norfolk, let at present for only two shillings and sixpence per acre, which the proprietors have refused to have put into a course of tillage at a rent of ten shillings per acre, and upon a one-and-twenty years lease!

The lands, more particularly locked up from the plough, are all those gradations of soil comprehended between strong clay and unctuous loam; those lands, in ſhort, which are not adapted to turnips, and on which ſheep cannot be folded to conſume the turnips with advantage. It is a received opinion, that on this ſort of land the plough can rarely be admitted without injury,

It is the intention of this Paper to point out how lands of this deſcription, that is to ſay, all thoſe gradations of ſoil between strong clay and unctuous loam, may be ſo advantageouſly managed, while under the plough, as to afford the landlord an increaſe of rent, and be again converted to paſture without debaſement of its quality.

It may be neceſsary to premiſe, that nothing will be here ſtated, which is not the reſult of actual experiment, perſonal knowledge, or repeated obſervation, or elſe of ſuch well authenticated information as may be confidently relied on.

Whoever intends breaking up land, containing the leaſt particle of clay, need not be told, that it is eſsentially neceſsary to lay it as dry as poſsible; not only on account of the crop intended to be grown upon it, but for the conveniency of getting upon it at all times with the plough, carting on manure, and carrying away the produce.

The privilege of paring and burning ought never to be granted to a tenant, who is not under lease, or on whom his landlord cannot place implicit confidence. Where the privilege is in no danger of being abused, it may safely be indulged in.

In performing this operation, care should be taken to do it with a smothering heat; for if the fires are too intense, the ashes will be of inferior quality. The advantages of this practice are numerous: it in a great measure annihilates seed weeds; it is destructive to many kinds of insects, and other vermin noxious to agriculture; it decomposes whatever comes within the sphere of its activity; and the ashes it produces neutralizes the soil, and assist in the farther decomposition of vegetable and animal matters contained in it; and these substances it converts into suitable food for the future crop. Its operation on the soil is something analogous to the operation of malting on grain: as malting disposes the grain to part freely with its most nutritious principle, the saccharine matter, so will paring and burning dispose the soil profusely to part with its nutrition to the plants which are committed to it: and this it will do, not for a single year only, but for several years, according to its original degree of fertility, in ſucceſsion; and if the crops are exhausting ones, till it is soon worn out. Hence on pared and burned land, more so perhaps than on any other, no two exhausting crops should follow each other.

In Derbyshire, and that part of Yorkshire which borders upon it, and probably in many other parts of the kingdom, which I am not able to speak to, it is not unusual to pare and and burn as a preparation for wheat. And if the wheat be followed by turnips, rape, cabbages, or potatoes, according to the nature and quality of the soil, and the manure they respectively may have produced, returned to it, there is not much to be reprehended in the practice; though it would certainly be better to reverse it, and let a fertilizing crop take the lead. When this is done, and an exhausting and a fertilizing crop are taken alternately, the land when laid down again to graſs, provided it be judiciously performed, will be in better condition than when first broken up.

If you commence your operations with paring and burning, your are obviously to be regulated in your choice of the season for performing it, not only by the intended crop, but by the weather, and the moist or dry state of the soil itself. If the work can be executed, which sometimes it may be, early in in spring, your first crop, provided the soil be not too stiff, may be potatoes, which may be followed by wheat. Rape, turnips, (to be drawn off) or cabbages present themselves, if you are not early enough for potatoes. Should your choice fall on the two former, the ground may be cleared time enough for wheat: if on the latter, barley will be your next crop. The crops to succed wheat are, drilled beans, peas and beans mixed, or tares, to be mown green, or eaten off upon the ground. Many object to tares on cold clayey soils, as being too backward in spring, a time when green food is certainly most valuable. On such soils it must be confeſsed, they cannot be made that advantage of, which they may be on warm sands, or rich loams; neverthelеſs they may on the coldest soils be made to answer a very beneficial purpose. They may either be eaten off by sheep, or mown green for horses, milch-cows, young stock, and even hogs. When eatén off by sheep, the sheep should have acceſs only to part of the field at a time, and should be shifted to a fresh part every week, ten days or a fortnight, as occasion may require. They ought also to be driven to a graſs field at night, or folded, where folding makes a part of the agricultural system. For working horses they are excellent. A farmer, whom I knew in Leicestershire, used to maintain his horses entirely, and other cattle in part, upon tares for two months in the season. A great part of his farm, on which he sowed tares indiscriminately, was a cold clay. I have frequently heard him speak of them as one of his most valuable crops. Where the tares were off time enough, he sowed turnips. After the latter-mown tares, the land was fallowed to be ready for barley in the spring. His turnips were drawn off. The great objection to winter crops, requiring to be carted off, exclusive of the labour, is the injury that is oftentimes done by cutting up and poaching the ground by the cart and horses. The person I have just spoken of, as soon as the land grew mirey, laid aside his carts, and used sledges, which having an extended base, will slide aloft, where a cart would sink and be laid fast.

A better method, however, has been adopted by a friend of mine in Derbyshire, the greater part of whose farm is of that kind of soil which will not admit of the winter crops being eaten on the ground. He has his land ploughed into narrow ridges of such a determinate width as to allow the wheels of the carts, which he uses for drawing off his winter crops, to run in the furrows. His horses, or oxen, draw double, and the shafts of the carts are at such a distance apart, as that the animals go in the furrows also. By this contrivance, the labour of drawing off the crop is much reduced, as both the horses and carriage go upon the firmest ground, and the land is not so much cut up and poached. There is no disadvantage in the ridges being narrow; on the contrary, the narrower the ridges, if properly formed, the drier they will be.—This practice, wherever it can be adopted, is well worth attending to, as it removes a great difficulty and objection to the growing winter crops on clayey or other soils, where they cannot be eaten on the ground.

A different, and, it is poſsible, a still better method has been suggested to me by one, of whose knowledge and experience as a practical farmer I have reason to think highly, and consequently feel disposed to pay a deference to any speculative idea he may throw out on this subject. He proposes either to make use of moveable sheds, (such as they have in Flanders,) but with the addition of a floor of wattled hurdles; or else to have an open fold, with a floor of the like kind. Were this practice to be adopted, a space should be first cleared of the crop to be consumed, equal to the size of the intended fold. The food must be given in racks or cribs. As fresh ground is cleared, a fresh fold should be prepared. The hurdles which composed the floor of the first fold, will be getting dry against they are wanted a second time.

The advantages attending this contrivance would be many; the sheep would be kept out of the mire, neither would the land be cut up nor poached; and the trouble, expense and inconveniency of carting the food from the field, and bringing the dung back again, would be saved, as in this case it would be deposited where it was produced. Some inconveniencies might probably arise which do not immediately present themselves: perhaps, where the hurdles lay hollow, there might be danger of their breaking; perhaps it might be uncomfortable for the sheep to lie down upon them. The expense would not at all events be great; the price of hurdles, three yards long by one wide, is in general, not more than six or eight-and-twenty shillings a score. Allowing each sheep two square yards, the flooring of a fold that would contain an hundred, would cost between four and five pounds. With care they would last, at least, two if not three seasons; and even when no longer fit for their original destination, they would not be without their value as fire-wood.

The idea, as it is new, will by many, no doubt, be treated as visionary. But as it may be brought to the test of experiment for a few shillings, upon a small scale, it would be no great waste of time to ascertain its practicability. Were it even to fail, it is poſsible it might suggest some farther idea, by which the object in view might be accomplished.

Much has been said and written on the subject of rotation of crops: if the rotation be such, as to take in alternately an exhausting and fertilizing one, it seems to be of little consequence, (except, perhaps, in the case of wheat following clover,) in what order they succeed each other.

By exhausting crops, every one knows, are understood, wheat, rye, barley, and oats; by fertilizing ones, crops of every kind which are consumed upon the land, or mown, or carried off before they perfect their seed, and which are brought back again in the state of manure. Peas and beans also, though scarcely fertilizing crops, properly so called, have an ameliorating tendency, by smothering weeds, and by leaving the soil in a moist and open state, proper for the reception of wheat.

On strong lands, the following courses I have known succeſsfully practised:

Beans,
Wheat,
Cabbages,
Barley,
Clover;

this course presents three ameliorating crops to two exhausting ones.

Potatoes,
Wheat,
Turnips (carried off,)
Barley, and sometimes oats;

this was a very common course about twenty years ago in a bleak part of Derbyshire, where I formerly resided.

Wheat,
Tares, and afterwards turnips,
Barley,
Clover, or
Wheat,
Tares,
Oats,
Turnips;

these were the general courses, with few deviations, observed by the Leicestershire farmer mentioned before.

It admits not of a question, that an acre of clover, tares, rape, turnips, or cabbages, will furnish at least twice the food that the same acre would have done, had it remained in pasture; by any one of these courses, therefore, it follows that the land would maintain, at least, as much stock as when in graſs, besides producing every other year a valuable crop of corn. No calculation is made upon the value of the straw, which whether consumed as litter, or as food, will add considerably to the stock of manure.

That the condition of the land would be improved, there can scarcely remain a doubt upon the mind of any man, who will consider the subject attentively. The plough by pulverizing the soil and breaking its tenacity, not only gives admiſsion to the fertilizing influence of the atmosphere, but by intimately mixing the manure, prevents that tenacity taking place in future, so long at least as the manure remains totally unexhausted. But as the soil will have a fresh and ample supply every other year, the stock of manure, with its concomitant fertility, will rather accumulate than be diminished; in consequence of which, whenever it is again converted into pasture, it will be in superior condition to what it was when first broken up.

A principal circumstance, which the landowner has to attend to, is the laying down his land to graſs. On this being well or ill executed, will greatly depend its future value. It is needleſs to observe, that it ought to be in the best poſsible condition, contrary to the practice which formerly prevailed of cropping the ground, so long as it would produce any thing; and then suspending the plough, till such time as the land recovered itself. A summer's fallow on all tenacious soils, should always precede the sowing of permanent graſs-seeds.

It has been much disputed, whether land should be laid down with a crop of corn, or with graſs-seeds only. Which method would be attended with the more immediate profit, admits not of a question; and as that profit affects the public, as well as the farmer, and without any apparent injury to the proprietor, the argument preponderates in favour of laying down land with a crop of corn. Both methods, however, I have seen practised with succeſs.

The great error in laying down land to graſs, stiff land particularly, is not allowing seed enough.

Previously to its being laid down, the land should be got into very fine tilth, and well manured, with the addition of lime and vegetable ashes of any kind, if they can be procured.

Various opinions prevail respecting the kinds and proportions of the different graſs-seeds to be sown. I knew a gentleman, whose farm, which was an extensive one, consisted chiefly of strong rich clay, all of which I may aſsert to have known, at one time or other in tillage; indeed, I do not recollect scarcely a single field, except what was subject to inundation, which had not been broken up and laid down again more than once, within my own memory. His practice was to lay down with a crop of barley, and to sow 14 *pounds of white clover. a peck of rib-graſs, and three quarters of hay-seeds* per acre. By this liberal allowance of seed, he always secured a thick coat of herbage the first year; which differed from old pasture only in being more luxuriant.

It was his opinion, and his practice was in conformity to it, that no land was injured by the plough, if judiciously managed: For though it might not carry, for the first year or two, such heavy cattle as it would afterwards, yet he always found that in the mean time, it would support and fatten more in number of a smaller size.

I mention this instance, as not only coming within my own immediate knowledge and daily observation, (for, indeed, I stood in the nearest degree of relationship to the person alluded to, being one of his family,) but as it proves that strong clay land may be broken up and brought back again into graſs, not merely without injury, but with advantage.

In breaking up old pasture, of which the soil is clay, should paring and burning not be approved of, the first crop may be beans sown broad-cast under furrow, or what is better dibbled in: these are to be succeeded by wheat. As soon as conveniently may be after the wheat is harvested, the land should be prepared for a winter fallow, and if cabbages are intended for the future crop, ploughed into three feet ridges. In performing this operation, the ridges should be laid as high and narrow as poſsible, the furrows wide and open. In this form, the ridges will receive the full influence of the air, sun, and frost; and by the furrows being wide and open, the water will run off immediately as it falls.

In the beginning of April, dung should be laid in the furrows and covered by the plough; by which means, the furrow and ridge will change places. Cabbages, which are intended to be consumed early in winter, should be planted out about the latter end of April, or as soon as the ground can be got ready, the seed being sown in July or August preceding. They should be planted on the ridges three feet asunder, and horse and hand-hoed when neceſsary: if a succeſsion be wanted till late in the spring, the planting should continue at intervals, till the beginning of July. The late-planted cabbages should be raised from seed sown in February.

The American drum-headed cabbage is the best for the first crop; for the spring use, the Scotch cabbage is preferable, as being more hardy and leſs disposed to run to seed early in in the season.

Cabbages are much cultivated in many parts of the kingdom, particularly in Leicestershire and Lincolnshire, where they are given to sheep, especially to ewes and lambs in the spring, and are greatly preferred to turnips, where the soil is too moist and adhesive to admit of the turnips being eaten off. There is no stock they may not be given to with advantage, whether milch-cows, feeding cattle, or stores.

A gentleman in Lincolnshire, who grows them upon a large scale, calculates a fair crop of cabbages at 12l. per acre. I have frequently given them with great advantage to milch-cows and young cattle; but not attending to the circumstance at the time, am not able to speak to their value when applied to that kind of stock. In giving them to milch-cows, care should be taken to strip off all decayed leaves, otherwise they communicate a very disagreeable flavour to the milk and butter.

Land which has produced cabbages, will be in suitable condition for barley; to which, in regular course, will succeed red clover. The course may then recommence as before, or the beans may be omitted. In situations commanding lime, the lime should be applied after the cabbages. In the place of cabbages, tares or rape may be substituted, should they more conveniently accommodate themselves to the exigency of the farm.

Beans and wheat alternately I have known tried, and with ſucceſs; manuring for the beans every other course. But I think this course inferior to the former one, as it does not afford its due proportion of food for cattle, (unleſs indeed, the beans are all consumed at home,) and consequently would not effectually furnish the neceſsary supply of manure.

Potatoes and wheat have been recommended, and which I have known practised upon a small scale for some years. It is now, I understand, in that part of the country where I formerly knew it practised, in a great degree laid aside, under the idea, that repeated crops of potatoes impoverish the soil. I rather believe, when long persisted in, they render the soil of too loose a texture for wheat.

There seems to be no reason why a limited time should be prescribed for continuing strong land under tillage. Indeed, from every observation I have been able to make, I should conclude, that so long as the tillage was conducted upon a right principle, so long would the soil not only retain its original fertility, but in some degree, would be advancing in improvement. That strong land is not injured even by continual tillage, we may have a convincing proof, by only adverting to any of the new inclosures which have taken place in our own memories. We shall find upon examination, that those lands which had been well managed, though they had been under tillage for centuries, are, now that they are laid down in graſs, as good land as the adjoining fields, which have probably never been disturbed for ages.

There is a certain degree of exhaustion which every soil will bear annually without any perceptible injury, and which is uniformly regulated by the innate fertility of the soil itself. Nature, however, has providently contrived, that where that degree of annual exhaustion, which the soil will sustain without injury, is exceeded, little farther is required to enable it to recover itself, than that it should have rest or lie fallow: that this is a fact, we need only look at those open fields where the common course is wheat, beans, fallow. What reason is there to ſuppoſe the soil leſs fertile now than it was formerly? If it be not leſs fertile, what but the fallow-year restores it? It is true, the fallow is commonly assisted by a dreſsing of manure; but if with no other manure than the land itself furnished, it is in no degree adequate to the robbery the soil must have sustained by producing two crops of grain in succeſsion. We may, therefore, conclude, that if the fallow, aſsisted by the manure the preceding crops had produced, did not completely renovate the soil, common fields would long ago have been reduced to a *caput mortuum*. But what puts this renovating property of a fallow out of all controversy, is a fact recorded by Mr. Young*. The practice he speaks of prevails also, I have been informed, in some parts of Eſsex.

If, therefore, land will recover the exhaustion of any single year by a year's fallow, we may reasonably presume it will more than recover what it has lost, by producing a crop which shall not only not exhaust, as no crops are supposed to do gathered green, but at the same time, shall supply a large stock of manure.

What is it that has so much improved within this last half century, the value of light soils, but the introduction of that system of agriculture, which prescribes an alternation of exhausting and fertilizing crops? Before the turnip husbandry was introduced, a great deal of light sand land was scarcely worth cultivating. The introduction of that vegetable alone has improved the value of such property in most cases three and four fold; and in many instances, ten and even twenty fold. I am aware, that the improvement may be attributed not only to the plentiful supply of manure, furnished by a turnip crop, but from the soil being consolidated by the trampling of the cattle in consuming it on the ground. This advantage, it must be confeſsed, clay land cannot have, neither does it stand in need of it; for, indeed, the consolidation which sand land wants, it already poſseſses, and commonly in a greater degree than is neceſsary. Fertilizing crops, which are not consumed where they grow, have a natural tendency to counteract the adhesive quality of strong soils, both by loosening the soil, and by the repeated ploughings they acquire; so that, besides the benefits they have in common, the advantage which sand land derives in one way by the production of a fertilizing crop, clay land obtains in another.

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* Agricultural Survey of Lincolnshire, p. 107.

There seems to be no question that barley is in general the fittest grain to be sown with graſs-seeds. The same tilth, which answers for the one, is requisite for the other. Barley has a disposition to loosen the texture of the ground in which it grows; a circumstance highly favourable to the vegetation of graſs-seeds, which require a free and open soil to extend their roots in; the tender and delicate fibres of which, have much difficulty in contending with the resistance of a stubborn soil. And this points out the reason why graſs-seeds so frequently fail on strong land, not in a proper state of cultivation. There is, however, little danger of their succeſs, when the ground has been well fallowed in the preceding summer, (which it ought always to be, previously to its being laid down) and brought into fine tilth and condition In the choice of barley, that sort should be preferred which runs least to straw, and which is the soonest ripe.

It is a practice with several, in laying down land to pasture, to confine themselves solely to the artificial graſses, under the idea that along with the hay-seeds, they run the risk of stocking their fields with many useleſs, if not noxious, plants.

It is not to be denied, that along with the hay-seeds are sown the seeds of many plants, which ought certainly, if they could be, to be excluded. But if with these, you exclude also the natural graſses, you deprive your pasture of its most valuable herbage.

It is much to be wished that the different kinds of natural graſses, as they are called, were to be cultivated apart, together with such other plants, of which there is variety, as cattle are observed more particularly to affect. Were this once done, and the properties of the different graſses and plants carefully ascertained, with regard to their several tendencies to fatten, to stimulate appetite, or promote digestion, such a combination might be formed as to produce pastures superior to any that are known at present. Till that period, however, shall arrive, hay-seeds, it is to be hoped, will retain their station, care only being taken, which, indeed, is a matter of the utmost importance, to collect them from hay-ground of the best quality.

As soon as the barley is harvested, it will be of great service to the infant plants, to draw a moderately heavy roller over them, provided the ground be dry, and yet in that state as not to be altogether insensible to the impreſſion of the roller. Unleſs it be very luxuriant, no stock should be suffered to pasture upon new graſs on any account, till the following spring; and before cattle are then turned upon it, it should be suffered to get a good head, and it should never be eaten bare.

I have not known many instances of new graſs being mown the first year after sowing; and in the few in which I recollect the practice, it was chiefly with a view of obtaining seed to lay down other fields with. The expedient, I remember, answered exceedingly well. The graſs being of good quality, and suffered to stand till the seed was perfectly ripe, the crop was abundant. It was thrashed out, and the hay (which, indeed, was little better than straw) given to the cattle in the fold-yard. The seed being arrived at maturity, and not heated, as common hay-seeds are apt to be, in the stack, there is reason to conclude that every grain, thus saved, would vegetate. What was the immediate effect on the field from which they were gathered, inthe few cases I speak of, I cannot now charge my memory with. Had it been any thing perceptible, I have no doubt I should still retain some impreſsion of it.

As the tenant has had his advantage in breaking up the soil, it seems reasonable he should be at the expense of the graſs-seeds for laying it down again; though, perhaps, it would be expedient for the landlord to furnish them, charging them to the tenant. He would thus be certain of the proper sorts and quantities being applied. For though it is the interest of both landlord and tenant that the land should be properly laid down, yet as the former has not only a present but a permanent interest in the event, he has a double inducement to take care that the buſineſs is properly executed.

Nothing would be more easy than to prescribe "a rule by which an increase of rent might be computed, where permiſsion is given to break up old pasture now under lease," provided the future profits of the tenant, in consequence of such permiſsion, could be accurately ascertained, and compared with the profits he makes at present. Could this be done satisfactorily, equity would direct that the increased profit should be divided between the landlord and tenant in equal proportions, a deduction being made for the tenant's trouble and exertion in obtaining it. It would be no unreasonable allowance to set apart one-third of the increased profit as an equivalent for the extra trouble and exertion of the tenant. But as the whole must be a matter of unavoidable contingency, depending not only on the variation of seasons, but fluctuation of price, the landlord ought certainly to content himself with a much leſs proportion than one-third. Supposing a calculation to be made upon the average chance of increased profit, twenty, or at the most five-and-twenty, per cent. on that calculation seems to be no inequitable compensation; and it would add still more to the equity of it, if this compensation were reduced to a corn-rent.

It will be observed, that in this Eſsay I have confined myself solely to the consideration of strong soils, improper for the common course of turnip husbandry. But the same arguments which are made use of to show the expediency and policy of occasionally ploughing up strong land, will apply with more than equal force in inculcating the neceſsity of ploughing up soils of a different quality, were any arguments, indeed, wanting to recommend a practice, the importance of which, as applied to light soils, is so universally understood.

To have entered into the minutiæ of the different operations required in a course of husbandry, such as is here recommended, or to have directed the specific modes of conducting them, &c. would have been repeating, and to no useful purpose, what is already known to every practical farmer, and, indeed, to every theoretical one. I have consequently avoided dwelling unneceſsarily upon that, which it would have been superfluous to have written upon, and which could not fail of being tedious in the perusal.

It may not, however, be improper, before the subject is finally dismiſsed, to remark, that were the system here proposed to be acted upon, it would probably be neceſsary for the farmer to make some slight alteration in the arrangement of his stock. On this head no general rule can be laid down. Every one must adopt that arrangement which shall best suit his own particular case. In many cases, however, no alteration of any kind need to take place. Upon every grazing farm a certain portion of it is set apart for hay. While, therefore, the pasture was under tillage, the meadow might, and most probably would, be converted into pasture; clover, straw, and green food, making a reserve of hay unneceſsary.

That system of agriculture, permit me to repeat, is the most perfect which obtains the greatest produce (as applied to raising articles of food) from a given quantity of ground at the least expense. And in no way can such produce be so effectually obtained as by a course of crops, furnishing sustenance to man and cattle alternately. In this course there is nothing of novelty or experiment; it has been known probably for ages *; and the practice

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* Hartlib, who lived nearly two centuries ago, says, that in Normandy it was customary to feed the cattle in the winter on boiled turnips. The custom, however, is of much older date: Columella, who wrote in the time of Tiberius, mentions the giving turnips to cattle in the winter, as a practice that prevailed amongst the Gauls even in his time. From the manner in which he relates the circumstance, there is reason to conclude the turnips underwent some culinary preparation. It is a curious circumstance that a practice, which is considered even at this day as a novel and refined improvement in husbandry, should have been familiarly known at so remote a period, and amongst so rude a people.

Columella speaks also of its being a common practice in some parts of Spain to grow corn, to stand for a crop, and to be mown green for fodder, alternately. Here is another modern improvement, at least as old as the Christian æra! Lib. ii. cap. 10, et 11.

of it has already been adopted, with the happiest effect, on many of the light lands in this kingdom, particularly in Norfolk, for more than half a century past. That it is equally practicable and expedient on heavy soils, it has been the buſineſs of this Eſsay to point out and to prove.

ESSAY XVIII.

On raising Wheat for a series of years on the same land.

THE erroneous idea, that plants draw from the earth such particles as are congenial to their own natures, has occasioned the farming maxim, " That wheat cannot be raised for a a series of years on the same land." But the truth is, that under the broad-cast husbandry, there is not sufficient time for manuring and stirring the ground between the operations of reaping and sowing. Such being the case, may we not remove the obstacle by substituting " transplanting" for " sowing;" with a view to decide on this important question, I instituted many small experiments, none of which exceeded the forty-eighth part of an acre, and from my succeſs in that way, I was induced, last year, (1801) to make an experiment upon a more extensive scale, in the middle of a field of six acres, at that time sown with wheat, broad-cast. The land taken for my experiment, measured exactly the ninth part of an acre; it had the same management as the other lands in the field, but with this difference, that the experimental land had an additional ploughing, a few days before transplanting, a circumstance of considerable moment. The progreſs of the experiment was this: In October, 1800, a pint of wheat was drilled upon a piece of garden ground and in the third week of March following, the plants were taken up with a spade, in order to be transplanted upon the land ploughed and harrowed fine for their reception. At this time the plants had just begun to show their coronal roots. Trenches, at the distance of nine inches, were drawn with a hoe, and into them the plants were laid, in a reclining posture, and at the distance of nine inches from each other; so that each plant had eighty-one inches of soil to grow in, whereas in broadcast sowing, each plant has not poſseſsion of more than eighteen inches. The expense of transplanting was estimated, by a skilful farmer, at twenty-eight shillings per acre, but in proportion to the increased skill of the planters, mostly women and children, the expense will naturally diminish. The land was rather neglected, having been but once hoed, and from the time of planting, to the harvest, no wheat could look better. When thrashed, the crop measured out near three bushels of marketable grain, a product as near as poſsible to what was produced on the contiguous lands of the same field. And here I beg leave to remark, that the whole field was foul, and not in good condition. This present year, (1802) I have prepared the same land to receive another crop of transplanted wheat; and I propose to continue the experiment for a series of years upon the same land, a thing of great importance, and hitherto deemed impracticable. Independent, however, of the original purpose, it is probable that the transplanting of wheat, for a single year, will turn out a beneficial improvement in the hands of a correct husbandman. I am inclined to think, that the third week in March, if the season be favourable, is the best tsme for transplanting wheat, as at that time the coronal roots begin to make their appearance. Till then, the plants are not in a condition to be transplanted, a circumstance that I wish to be attended to; no more plants should be taken up than can be put down in a day. It will be almost unneceſsary to remark, that when wheat is intended to be cultivated upon the same land for a series of years, the same quantity of manure, together with the same number of ploughings, should be annually bestowed upon it, as if only intended for a single crop. In the year of the above experiment, I had a rood of land under transplanted wheat in another field, which was then under broad-cast and drilled wheat. In this experiment the plants were put in by the dibble, as late as the middle of April, and the crop, at harvest, was allowed to be finer in ear than either the drilled or broad-cast; but by the neglect of the superintendant, the sheaves were not kept separate in the barn, and all that I could learn was, that the product of the field was at the rate of thirty-three bushels per acre; so I shall estimate the transplanted wheat at that rate.

Mr. Bogle, in a paper presented to the Bath Society, warmly recommends this mode of cultivation; and the Rev. Mr. Pike, much about the same time, gives a short but satisfactory hint relative to this subject, as published in the second volume of Mr. Young's Annals of Agriculture. Such being the case, I can assume no merit beyond the prosecution of the idea. As much of the succeſs of this scheme depends upon keeping the land clear of weeds by frequent and judicious hoeings, I wish to impreſs upon the minds of those gentlemen, who may make the trial, the neceſsity of personally attending to that operation.

When the land is not in high condition, I should prefer six inches to nine, a distance in which the hand-hoe will work with great ease. Upon the whole, I am inclined to recommend dibbling of the plants, in preference to the laying them in the furrows made by the hoe, as practised in one of my experiments, but when that mode is pursued, care should be taken not to place the crown of the plant deeper than one inch within the ground, being its natural position.

RECOMMENDATIONS.

1. By this scheme, only half a peck of seed wheat is required per acre, instead of two bushels and one peck, being the quantity usually sown broad-cast; and this is a consideration of infinite consequence, as the seed required for one acre "broad-cast" will be sufficient for twenty acres "transplanted."

2. It employs the feeble hands of the village at a time when they have but little employment.

3. Land that, in consequence of floods, has become too wet for sowing in October, may be cropped with transplanted wheat in the

spring, whereby the field will be kept in its regular course of tillage. A circumstance of great consequence in the eye of a correct and judicious farmer.

4. The wheat may be hoed at a small expense, whereby the mischievous consequences of hand-weeding will be avoided at an advanced season.

5. It will give the farmer a taste for garden-culture, which will insensibly remove the slovenliness too generally observed in farming operations.

6. It may be objected to this plan, that some difficulty will arise in obtaining a sufficient number of hands for the purpose of planting; but this objection will be over-ruled, when we consider the ease with which dibblers are now obtained in every district where dibbling is practised.

7. As it seems to be an established law in nature, that land will not push up more stalks from one root than she can well support, it follows, that the greater the surface a plant has to spread upon, the greater will be the number of stems produced. In this mode of culture,

each plant has eighty-one inches of soil to grow upon, whereas in the broad-cast husbandry, the plants have only about eighteen inches.

8. The land will have an additional ploughin March, which will effectually destroy such weeds as are beginning to vegetate; and as the wheat will cover much of the ground after the first hoeing, we may expect to keep the land perfectly clean and free from weeds, at the expense of a second stirring by the hoe.

9. As soon as the crop is cut down, may we not take the earliest opportunity to sow winter tares, with a view to be eaten off previous to the transplanting in spring, especially as Mr. Bogle says, that wheat may be transplanted as late as May? Or rather, may not stubble-turnips, brocoli, or rape be advantageously introduced, to occupy the land from harvest to March or April? Some may say, that this will be distreſsing the land, but I answer, if land be well manured, well stirred, kept clear of weeds, and cropped in a judicious manner, that it never can be distreſsed. Should experience prove the justneſs of this

idea, a field of five acres, kept continually under transplanted wheat, will afford a sufficient supply of bread corn for a family of thirteen persons. After all, I consider this scheme more in a speculative than in a practical light.

MEMORANDUM. *The transplanted wheat of this year, as mentioned in the body of this Essay, was, in the course of the spring, entirely destroyed by the wire-worm, which unfortunate circumstance has broke the thread of my experiment; and it is now too late in my life to begin it anew.*

ESSAY XIX.

On Floating Land.

THE most valuable, and I had almost said, the only improvements of magnitude that have of late years been made, here, in agriculture, have been in the various provisions of green food, afforded for the neceſsity of winter, and for the more preſsing wants of the two first months of spring. In this series of improvements, I beg leave to claſs, "floating of land," which, though it cannot, in every situation, be so widely extended as the cultivation of turnips, rape, cabbage, lucerne, &c. yet where it can be fully executed, it will in no wise disgrace the relationship in which I have placed it, but will afford it abundant aid and support. For floated meadows not only require no manure from the farm yard, but liberally encourage the plough, by affording an annual extra supply of manure: and although, by this practice the farmer cannot provide green food for all the months of winter, yet he can, thereby, considerably shorten the wintry void; for, in March and April, which are the two most trying months to the farmer, these meadows are covered with graſs enough to receive any kind of stock, if the weather will permit.

The following is a strong proof of the great utility of this practice: Having heard that the proprietor of an old floated meadow, had disposed of the produce of it, in the year 1795, in a way that was well calculated to ascertain its real value, I wrote to a person who resides on the spot, requesting him to send me a particular account of the product of the meadow, and I received the following statement.

" In order to make the most of the spring
" feed, the proprietor kept the graſs untouch-
" ed till the second day of April, from which
" time, he let it to the neighbouring farmers,
" to be eaten off in five weeks, by the after-
" mentioned stock, at the following rates per
" head: a sheep 10d. per week, a cow 3s. 6d.
" a colt 4s.

	l.	s.	d.
107 Weather sheep, one week	4	9	2
8 Cows - - - - - - - - ditto	1	8	0
4 Colts - - - - - - - - ditto	0	16	0
	6	13	2
			5
Total of five weeks	33	5	10
3 Colts, 3 weeks to be added	1	16	0
Total	35	1	10

After this statement, my correspondent, sensible that it is this spring crop which principally claims the attention of the public, and on which I ought to lay peculiar streſs in recommending the practice, dismiſses the subject with saying, that the hay crop was, as usual, about fifteen tons, and was six weeks in growing.

The above sum, it should be observed, was made by the owner of this meadow, at a time when other graſs land is in a dormant state, or exhibits but feeble symptoms of vegetation. He had received more than four pounds an acre for his land, when his leſs fortunate neighbours were only looking forward to two future crops, in which expectation he has, at least, an equal prospect with them.

But the advantages of this art will be seen in a still stronger light, when we are told, that this meadow, which is now in the occupation of a miller, was a few years ago, in the hands of a farmer, who being at variance with the miller, was entirely deprived of the use of the water for a whole winter, which unfortunately was succeeded by a very dry spring and summer; of course, the spring-feed was lost, and the whole hay-crop of eight acres was only three tons.

Such a specimen of productiveneſs as the above, one would hope, will carry sufficient weight with it, to turn the scale against any objections to the practice, arising from a dread of expense, or from an aversion which many entertain to what they stile cutting their land to pieces; and will prevail upon every one who poſsibly can, to adopt this mode of improving his land. I trust, likewise, that the above instance of fertility will be esteemed a proof that this is not merely book-farming, but is worthy the attention of real practical farmers; and in confirmation of this, I could produce several instances of *renters* of land, having profitably expended several hundred pounds in forming meadows of this kind, without any allowance from their landlords; than which, a more clear demonstration of the great utility of floating, in my opinion, cannot be given.

ESSAY XX.

On the Rise and Ascent of Vapours.

IN the Philosophical Transactions, vol. 59, for the year 1769, is inserted a paper upon the different quantities of rain which fell at different heights over the same spot of ground, by William Heberden, M. D. F. R. S. in which he says, "What may be the cause of this extraordinary difference has not yet been discovered. It is probable that some hitherto unknown property of electricity is concerned in this phænomenon."

I have often thought that the true cause of the ascent of vapours in the air, which form meteors, hath not yet been discovered, or at least, enough attended to; and of consequence, many phænomena attending thereon appear unaccountable and intricate. Having frequently, of late, given some attention to this subject, I am inclined to believe, that, by considering it in a new point of view, some light may be thrown upon it.

Various have been the opinions of Philosophers in their attempts to account for the ascent of vapours from the earth, their suspension in the air, forming clouds, rain, &c. Each hypothesis has had its followers; but many of their data being false, and not agreeable to nature, their endeavours fell, in course, short of their expectations. I shall just mention two or three which have been the most generally received.

The Cartesians tell us, that the particles of water are formed into hollow spherules by the solar heat; these being filled with subtile matter, become lighter than air, and are easily buoyed up in it. But as we are now afsured that this *materia subtilis* has no foundation in nature, all reasoning from it must be rejected.

Dr. Nieuwentyt, and several others, in order to account for the ascent of water in air, a fluid so much lighter than itself, imagined that particles of fire, separated from the rays of the sun, and adhering to the particles of water, make, together, little bodies lighter than an equal bulk of air, which must therefore rise therein, till they arrive at such an height as to meet with air of the same specific gravity with themselves, forming there a thin cloud. They supposed that rain was produced by the separation of those particles of fire from the water, whereupon the latter coalesce, and descend, according to their own gravity, in drops of rain or dew. A small degree of consideration will prove this hypothesis to be erroneous. We need only to reflect, that heat must also be generated by such a combination, and we ought to be sensible of an extraordinary degree of warmth in paſsing through a cloud, whereas the vapour is really colder than rain itself; heat should likewise, according to this theory, be produced by evaporation; but we find it, on the contrary, to generate cold to an exceſsive degree.

Another opinion concerning the rise and suspension of vapours is, that though water be many times specifically heavier than air, yet if the surface of it be increased, by greatly diminishing the bulk of its particles, it cannot easily fall; since the weight of each particle is known to diminish in proportion to the cube of its diameter; whereas the surface, to which the air resists, decreases only as its square; and this is sufficiently evident from the floating of dust, motes, and other light bodies for a time therein, according as they are more or leſs minute. To be convinced of the insufficiency of this notion, we need only consider, that the rising of dust, &c. in the air, is constantly owing to the application of some external force; whereas vapours are always rising, as well in calm as windy weather, neither do they fall to the ground, or subside, when the wind ceases, unleſs under certain conditions, and the air is always loaded with them.

The most generally received opinion is, that, by the action of the solar heat on the surface of the water, the acqueous particles are formed into globules filled with a flatus, or warm air. They are thus rendered specifically lighter than common air, and must rise therein, till they meet with such as is of equal specific gravity with themselves. But we are well aſsured that there can be no flatus within these globules, warmer or more rarefied than the air that surrounds them, as the action of the sun is equal in strength on every part of the surface; and if they could be formed, their existence would be only momentary, as we see in the bubbles of soaped water, when blown up by the warm air from the lungs; nay, soaped water is much more tenacious than common water, and must, consequently, keep the air longer inclosed. To the formation of these bubbles a warm air from the lungs is required; on the contrary, as we have mentioned above, cold is generated by evaporation.

Dr. Desaguliers, after endeavouring to confute the theories mentioned above, advances the following one of his own. He observes, with Sir Isaac Newton, that when the particles of a body are separated from their contact by heat or fermentation, their repulsive force grows stronger, and they exert that force at greater distances; so that the same body may be expanded into a very large space by becoming fluid, and may sometimes take up more than a million of times the room it did in a solid state. Thus, when the particles of water are turned into vapour, they repel each other strongly, and, at the same time, repel air more than they repel each other. Aggregates of such particles, made up of vapour and vacuity, according to this theory, will easily rise in air of different densities, as they are more or leſs attenuated by heat. He observes that heat acts more powerfully on water than on common air; for that the same degree of heat, which rarefies air two-thirds, will rarefy water near 1400 times, changing it into steam or vapour as it boils it. And, in winter, the small degree of heat, which, in respect of our bodies, appears cold, will raise a steam or vapour from water, at the same time that it condenses air. Alſo, that the density or rarity of this vapour depends chiefly on its degree of heat, and but little on the preſsure of the circumambient air. From which he infers, that the vapour being more rarefied near the surface of the earth, than the air is by the same degree of heat, it must neceſsarily be buoyed up into the atmosphere; and since it does not expand itself much, though the preſsure of the incumbent air grows leſs, it at length finds a place where the atmosphere is of the same specific gravity with itself, where it floats, till, by some accident or other, it is converted again into drops of water, and falls down in rain.

We may remark, that in all the theories above-mentioned, fire is looked upon as the principal or sole agent in the formation and ascent of vapours. Dr. Desaguliers gives the following experiment, to prove that air is not neceſsary for the formation of steam or vapour.

"Take a pretty large veſsel of water, which must be set upon the fire to boil. In this veſsel must be suspended a glaſs bell, made heavy enough to sink in water; but put in in such a manner, that it be filled with water when upright, so that no bubbles of air be left within. As the water boils, the bell will, by degrees, be emptied of its water, the water in the bell being preſsed down by the steam which rises from it; but as that steam has the appearance of air, in order to know whether it be air or not, take the veſsel off the fire, and draw up the bell till only the mouth remains under water; then, as the stem condenses by the cold air on the outside of the bell, the water will rise up into the bell, quite to the top, without any bubble above; which shows that the steam, which kept out the water, was not air."

But the Doctor was not aware that the rising of the bell in this experiment, which he supposed to be from the steam, is, in reality, owing to air discharged from the water in boiling, and which is reabsorbed by the water whilst cooling. See experiments by the Hon. Henry Cavendish, F. R. S. Philosoph. Trans. Anno 1766.

The rise and ascent of vapours into the atmosphere, is looked upon, by all philosophers, as a kind of natural distillation. This idea is, indeed, a necefsary consequence of every hypothesis, in which the action of fire is esteemed the principal agent. In which case, fire, solar and subterraneous, by joining with, or increasing the repellency of the particles of fluids, renders them capable of rising in the air, as vapours in an alembic; after which the coldnefs of the air condenses them, in the manner of the refrigeratory in common distillation; hence they descend, in the form of rain, upon the surface of the earth.

But we must observe, that a considerable degree of heat is necefsary to effect this; nay, very little vapour is seen to rise in the still till the water actually boils; it is also quickly condensed, nor is it capable of being much diffused in the air. For although the water in the refrigeratory be grown very hot, you will scarce perceive the least vapour come from the mouth of the worm; the whole seems entirely condensed into water: Whereas we see that vapours are raised from the earth in places most remote from the action of the sun, and far removed from the influence of subterraneous heat; here the supposed powerful action of fire, is, I presume, totally inadequate to the effect.

Vapours are continually rising in wet caverns and subterraneous places, to which little heat can have accefs. These are sometimes formed into ice. In the Memoirs of the Academy of Sciences, we are told that in September, 1711, near Basançon, there were found three pyramids of ice, fifteen or sixteen feet high, and five or six in circumference, in a cavern eighty feet deep, the bottom of which was covered with three feet of ice: And we know that all grottos and caverns under ground, are constantly found very damp and moist. Vapours also rise in great quantities from ice itself; though kept in very cold places, and remote from the influence of the sun.

We are hence certain, that evaporation goes on in places where the rays of the sun never reach; the dampnefs, coldnefs, and ice found in these subterraneous mansions, show no degree of heat in any degree answerable to the effect, as being the immediate cause of the rise of vapours.

In Greenland, during the absence of the

sun, or winter season, when the cold was so intense as to raise blisters on the skin, and to congeal brandy, the air was very misty, cloudy, and heavy snows fell; hence we find a considerable ascent of vapours where the action of heat was extremely weak and confined.

If it could be allowed that the ascent of vapours depended solely upon the action of heat, it would then appear impoſsible that they could be able to rise any considerable height into the air. We know that the vapours in distillation are condensed, even when every part of the apparatus is become very hot; this must happen to vapours before they arrive at any considerable height.

If you ascend a high mountain in a hot sultry day, at the summit you will shudder with cold, the plains below being at the same time parched up with heat.

In many parts of the torrid zone, where they faint in the valley under a vertical sun, the highest mountains are frequently covered with snow; the summits produce variety of plants and animals: there must be, from thence, a considerable and constant evaporation.

If the ascent of vapours was alone caused by the action of heat, they could only be diffused through the air; and I presume that, if this was the case, it would be impoſsible but that the transparency of the air must be destroyed; so great a quantity of steam would never suffer us to see the celestial bodies; nay, the rays of light could not but be so variously refracted, as to prevent our seeing any object upon the surface of the earth distinctly, as in thick mists.

The quantity of water in the atmosphere, at all times, is prodigious; and of this we may form a tolerable idea from the following considerations;

First, The quantity of fluid exhaled from animal bodies. Sanctorius found, that the quantity exhaled from a human body, in the space of twenty-four hours, amounted to near five pounds in weight; how great must the quantity be from the whole race of mankind! We must take into this account the quantity of perspiration from the whole animal creation.

Secondly, The quantity of exhalation from vegetables. Dr. Hales says, from experiments, that the middle-rate perspiration from a sunflower, three feet and a half high, in the space of twelve hours, in a very dry day, was one pound four ounces avoirdupois weight; from which some degree of judgment may be formed of the great quantity of fluid daily exhaled from vegetables.

Thirdly, The immense quantity of exhalation from the water upon our globe. Dr. Hally, by observing the quantity evaporated from a veſsel full of water of the same degree of saltneſs with that of the ocean, calculated, that the quantity exhaled from the Mediterranean Sea only, in one summer's day, there being little wind, amounted to 5,280,000,000 tons of water.

If we consider how thick and dense the vapours hang over water, when heated, I think it will appear very evident that, if the ascent of vapours from the earth was owing to the same cause, we could never be able to have a distinct view of any object upon the surface of our globe.

Was the ascent of vapours owing to the immediate influence of fire, a sensible heat must be perceived, as the steam rising from water, under that circumstance, is very hot; on the contrary, we find a considerable degree of cold is produced by natural evaporation.

Dr. Franklin made the following experiment upon this subject. The ball of a thermometer was repeatedly and alternately wetted with æther, and blown upon with a pair of bellows to quicken the evaporation; by which means the included liquor descended from sixty-five degrees, the heat of the air at that time, down to seven; that is, twenty-five degrees below the freezing point. The bulb, at the end of the experiment, was covered near one-fourth of an inch thick with ice, proceeding either from water mixed with æther, or from the breath of the aſsistants.

Any one may observe that immediately after coming out of a bath, or washing the hands in water, a remarkable coldneſs is felt, unleſs the skin be well dried with a napkin; hence the neceſsity of drying the body very well after the use of bath, fomentations, &c.

This experiment not only shows cold to

be produced by evaporation, but that this proceſs goes on in an extreme degree of cold.

From these experiments we are led to conclude, that heat cannot be, as hath been universally agreed to, the chief and primary agent in the ascent of vapours. Some other power must then be discovered to elucidate this phænomenon.

I flatter myself that the following theory will be found leſs exceptionable than any other hitherto given.

The Cause of the Rise and Ascent of Vapours.

I presume that the rise and suspension of vapours is owing to the power of the air as a menstruum, capable of diſsolving, suspending, and intimately mixing the particles of water with itself.

All fluids are capable of diſsolving particular bodies, and as the air is a fluid we may conclude it to poſseſs that property.

The Hon. Mr. Boyle found, from experiments, that there was no exhalations from liquors in vacuo, but as soon as the air was let into the receiver, they rose up plentifully.

We know, from experiments, that the air contains, at all times, and in every part, a large quantity of water.

In this solution it appears, that an intimate union, or proper mixture, takes place between the aerial and aqueous particles, by which a compound is produced, perfectly clear and transparent, fit for the transmiſsion of the rays of light, and adapted to the economy of the animal and vegetable creation.

All menstruums are confined in their action, and can only take up a certain proportion of the solvent; when they have performed that, they are in a saturated state, and incapable of suspending more; if in this state the solution be any way weakened, a proportionate quantity of the suspended matter separates from the menstruum, and is precipitated.

The power and effect of all solvents is increased, in some degree, by heat, agitation, and the greater extension of the surface of the matter acted upon; and, by the contrary of these, their power is rendered weaker, and more confined.

As the air of our atmosphere is a perfect chaos of all kind of corpuscles, a sort of compound matter, consisting of air, water, emanations and exhalations from the three kingdoms of nature, we cannot have any certain idea of its nature and action in its most simple state. We must, therefore, at present be content with reasoning from analogy; and if we are by that made capable of accounting for the various phænomena attending the rise and ascent of vapours, it will be a strong presumption that my theory has some foundation in nature.

I shall lay it down as a rule, that the air is always in a saturated state, containing as much water as it can suspend, or nearly so; it being only from accidental causes that its solvent power is made stronger or weaker, causing the various phænomena observed in our atmosphere.

The air being reduced to the density which it has near the surface of the earth, by the weight of the superincumbent air, is more or leſs compreſsed, according to the greater or leſs weight of the atmosphere; hence the higher we go from the surface, the rarer is the air, as appears from experiments made with the barometer upon mountains. The greater the density of the air, the more powerful is its action as a menstruum, as a greater quantity of solvent is applied in a given space.

We may presume, that the water upon the surface of the earth rises up in consequence of the attractive power of the air as a menstruum, in which it becomes suspended, an intimate combination taking place. The nearer the air to the surface, the more it will be saturated; but the watery particles are soon, by the attraction of the air above, diffused to a greater height, and this, probably, to the very summit of the atmosphere: we are, however, certain of its presence at the tops of the highest mountains. It may be observed that, let the mists be never so thick near the surface, if we ascend a high mountain the air is found to be clear, and the mists are seen floating below. This may be illustrated by what happens in the making of tinctures; in which case, the veſsel being at rest, the menstruum becomes more highly impregnated the nearer it is to the surface of the solvent, but weaker and weaker the more remote from it.

Agreeable to this is an observation of Jacobus Zarabelli, given in Mr. Boyle's works.

"Contigit id meæ experientiæ, quod etiam aliis contigiſse audivi, ut ascenderim ad summitatem usque montis Veneris, qui omnium in patavino agro altiſsimus est; ibi per totum diem habui aerem sereniſsimum, sed infra circiter medium montis vidi nubes, quæ me visione vallium prohibebant, vesperi autum postquàm de illo monte descendi, inveni factam eo die infera parte magnam pluviam, cùm in montis cacumine nil pluiſset."

Nay, it has been observed, that no rain fell upon the top of the cathedral at York, when there was small drizzling rains with thick mists in the streets below. This only happens when the air is in a state of stagnation. The particles of all solvents are more universally diffused by agitation of the menstruum.

Have we not here an easy and natural solution of the phænomenon observed by Dr. Heberden, as mentioned at the beginning of this paper?

Of the Effect of Winds in aſsisting and promoting the Rise of Vapours.

I take the property of winds, in aſsisting the solvent power of the air, to be analogous to the effect of agitation in other menstruums. Their efficacy in drying up the water and moisture in the fields, roads, and streets, after heavy rains, and in damp weather, is obvious, and easily accounted for.

The air, as a menstruum, when at rest, can only take up and diſsolve a certain quantity of water; it becomes saturated and incapable of suspending more; but, when agitated by winds, the saturated part is blown off from contact with the surface of the solvent, and a fresh quantity of unsaturated air is immediately applied thereto. By which means the proceſs of evaporation goes forward with great celerity, and the moisture upon the surface of the earth is soon dried up.

In damp and low situations, such as marshes, bogs, and vallies surrounded by high mountains, there being no winds or agitation of the air, mists and fogs are seen hanging like thick clouds; and in such places the graſs and other vegetables appear loaded with drops of water, in consequence of a precipitation of the overcharge of water in the air.

In damp weather, with a stagnant state of the air, large towns and cities are observed, when viewed from a distance, to be covered with thick and almost impenetrable fogs, frequently hiding the whole from the sight, except, perhaps, the tops of high spires of churches. In this state of the air, the walls, ceilings of houses, marble slabs, &c. become damp, and covered with drops of water.

When a brisk wind gets up, these mists, or portions of over-saturated air, are carried off; in consequence of which the moisture is soon evaporated.

I have often, at four or five miles distance, observed the city of York obscured by thick mists, so as to prevent my seeing any part of it, except sometimes the very summit of the cathedral; and a wind then arising, such a quantity of over-saturated air was carried off, as to extend visibly, and without interruption, to a village two miles distant, towards the contrary point from which the wind blew. The air was at that time ſo clear in every other part, that I was able distinctly to perceive the high roads over the hills at fifteen or twenty miles distance.

When the air is at rest, or in a state of stagnation, it becomes impregnated with water beyond saturation, and cannot combine with the overcharge; as this can be only diffused, it soon precipitates, and falls in the form of rain.

The air is, for the most part, but little agitated, with us, when the wind is southerly; hence the reason why such winds are mostly attended with mists and small drizzling rains. In this case the rains are continual.

As the over saturation is only near the surface of the earth, the particles of water fall from a small height, and not having opportunity to collect themselves together, the rain must be small and drizzling.

When a brisk wind blows, the over-charged portion of air is driven by the agitation of the whole maſs, in various directions; part is carried up to a considerable height, swims about, and, by refracting the rays of light into different directions, become visible to us, forming clouds, which, soon losing their equilibrium, fall in rain. As the length of the paſsage in falling gives the aqueous particles opportunity to collect together, large drops are generally formed. Hence appears the reason why showers are usually of short continuance, sudden in coming, seldom attended with mists, and frequently intermixed with gleams of sunshine, in windy weather.

But as some winds, though boisterous, bring with them, at times, a quantity of over-saturated air, they will, of course, be attended with mists and drizzling rain; of this kind are the easterly winds with us, which blowing over a pretty large tract of sea, come charged with moisture. On the contrary, the north and westerly winds are generally dry, and attended with fine weather.

From a proper consideration of what is here advanced, a considerable light may be thrown upon agriculture.

Some lands naturally moist, though they may appear dry to a superficial observer, are found to encourage the growth of particular plants without the trouble of watering. The cultivator immediately gives it as an infallible rule, that such plants need not that aſsistance, in which he is soon followed by others glad to save the trouble and expense. In consequence of which, another farmer plants in land naturally dry. The crop, for want of its neceſsary moisture, disappoints his expectation; he wonders at the effect, but never reflects upon the cause.

We shall instance this in the culture of cabbages. Mr. Young, in his Northern Tour, informs us that Mr. Scroope planted this vegetable in the great drought of 1765, without watering, and is positive that it is a needleſs trouble. He is followed by Mr. Crowe and Mr. Turner. The Marquis of Rockingham, Mr Ellerker, and Mr Tucker, on the contrary, found the advantage of watering in dry seasons.

I shall not hesitate to say, that both these opinions, though capable of misleading the ignorant farmer, are justly founded, the difference proceeding from the natural dryneſs and moisture of the respective lands. Two closes, though contiguous, the one shall be found composed of a very moist and wet soil;

the other, to as great an extreme, dry and parched. Nay, different parts of the same field are often found, in this respect, to vary greatly in their natures, nor is this always indicated by external appearances.

Without attending to this subject, agriculture will be for ever a vague and uncertain study. The endeavour to raise any particular plant by the same mode of culture, in all kinds of land, is as absurd as to seek for the plant called Pile-wort in the deserts of Arabia.

I flatter myself that, if attention be given to what is laid down in this eſsay, the intelligent cultivator will be enabled to judge properly of the nature of his lands, regarding dryneſs and moisture; his fields and gardens will evidence its utility.

The aſsistance of the botanist may in this case be of great advantage. A collection of the most common and obvious plants, natural to different soils and situations, engraven and digested under their proper divisions, will be of great use in showing the difference of soils in different places. A person, from a thorough knowledge of this subject, will become capable of giving a right judgment of the intrinsic value of any parcel of land, from a short and transient view of it, and that with the greateſt exactneſs and certainty.

We know from experience, that vegetables do not solely depend upon their roots for a neceſsary supply of moisture, but absorb, through innumerable bibulous orifices dispersed all over their surfaces, a great quantity of water from the atmosphere.

This absorption can only take place when the air is in an over-saturated state; suffering, in consequence of this, a degree of precipitation, forming rain, mists, and dews. The higher the situation of any parcel of ground, *cæteris paribus*, the leſs will it be subject to mists and dews, and *è contra*.

This *radical* and *superficial* absorption is an admirable provision of nature, and seems absolutely neceſsary to the preservation of vegetables, by affording them a constant and plentiful supply of moisture.

Agreeable to this, it is probable that the lands on which Meſsrs. Scroope, Turner, and

Crowe planted their cabbages, were, from their situation, more liable to mists and dews than those where the Marquis of Rockingham, Meſsrs. Ellerker and Tucker made their experiments.

The superficial absorption of the plants, in the first case, together with the supply of natural moisture from the soil, proved sufficient without the aſsistance of watering. But, in the other, for want of sufficient moisture in the ground, and a proper supply from the atmosphere, the aſsistance of the planter become neceſsary.

We may, from hence, learn the bad consequences of forming general rules from particular experiments. A mode of culture shall answer very well upon one particular piece of ground, which will be found fruitleſs in another, though contiguous, and apparently of the same quality. Such is the variety observable in the works of nature.

In order to obtain an exact knowledge of the nature of particular lands, as to their degree of moisture, I would advise the cultivator not only to examine the soil itself, but also the probability of its being more or leſs supplied with water from the atmosphere.

Besides the methods in common use, I would visit my ground in a hot summer's day a little before sun-set, and carefully observe in what parts a mist or fog first appears; this will always be, *cæteris paribus*, over the part or parts where there is the greatest moisture, and will be the more distinctly seen in proportion to the greater heat of the preceding day.

The same observation may be made in a summer's morning about sun-rise; for the damper the ground, the longer the mists will be seen suspended over it.

I have observed a great difference in this respect, in different parts of one and the same field.

The Effect of Heat in aſsisting and promoting the Rise of Vapours.

As heat contributes to the action of all menstruums upon their solvents, we may conclude that it greatly aſsists the solvent power of the air upon water. The rationale of this remains yet to be discovered: we are, however, well acquainted with its effects.

If we diſsolve, in a sand-heat, as much nitre in water as it will suspend to saturation, and keep it in the same degree of heat, being secured from evaporation, it will for ever remain suspended, and the solution be clear and limpid; but if it be taken out of the sand-heat and exposed to the open air, the solvent power being weakened, the over-charged part of the nitre is detached from the water, and shoots into crystals, adhering to the part of the phial to which the greater degree of cold is applied.

In summer, when the solar rays fall more perpendicular upon the earth, the solvent power of the air is greatly increased, and that, *cæteris paribus*, in proportion to the degree of heat: at this time a much greater quantity of vapours exhale from the surface of the earth. This, indeed, is not very obvious when considered in a superficial manner, because the air appears to be really dryer at such seasons than in winter; fluids sooner evaporate, and leſs rain falls. But this, I presume, is owing to the action of the air, as a menstruum, rendered more powerful by the increase of heat, by which water is so immediately and intimately combined with it, as to escape our sight. Thus the exhalations from the lungs are imperceptible in a hot summer's day, which in winter iſsue out in clouds.

It does not solely depend upon the coldneſs of the air, that the breath of animals becomes visible therein: for we may observe this to be the case frequently when the air is warm and sultry; nay, above summer's heat, as is indicated by the thermometer; but at such times it is always very damp and misty. This observation seems to corroborate our hypothesis, in referring the rise of vapours into the atmosphere to the action of the air as a menstruum; not to the immediate agency of heat, which seems to be only an aſsistant principle, by no means absolutely neceſsary.

The air in the middle of summer, especially when the sun is not far removed from the meridian, is seldom over-saturated with moisture, except in deep vallies, boggy and swampy situations, or when attended with cold winds, stormy weather, &c. In some very hot countries, far removed from the sea, the surface of the earth being very dry, and the atmosphere not liable to storms and tempests, the air is never so over-saturated as to suffer any precipitation; hence it never rains.

The reflection of the solar rays from the surface of the earth, aſsists the action of the air upon water in some degree; but as this is confined merely to the part near the surface, its action cannot extend far. Hence, when the solvent power becomes weakened by any accident, the overcharge falls not from a height sufficient for the watery particles to collect into drops, but descends in the form of dew.

The action of subterraneous fires may, when great enough to warm the air over the surface, aſsist its solvent power; but as this is extremely confined and rare in its appearance, its effect can be but trifling.

We come next to consider the effect of cold, &c. in impeding the rise and suspension of vapours.

If we attribute the rise and suspension of vapours to the action of the air, as a menstruum, the power of cold, in impeding the proceſs, appears to be much limited; whereas, if this phænomenon was owing to the immediate action of heat, the absence of which, or cold, would effectually put a stop to it.

The solvent power of all fluids is owing to their quality as fluids; and as long as they continue fluid, and are prevented from becoming weaker, they will eternally keep this property of being menstrua to their proper solvends.

A certain degree of heat, neceſsary to keep fluids in their proper form, may poſsibly be required for the producing this phænomenon. But we have no idea of the smallneſs of the degree required in this case. We know that vapours may be raised, and that in great plenty, about the bulb of the thermometer, when the mercury is frozen by intense cold. May it not be probable, from hence, that the degree of cold, neceſsary to put an entire stop to the rise of vapours, must be so great as to change the very nature of the air as a fluid; nay, to render it a solid maſs?

The degree of cold common to the atmosphere, has a power of diminishing the solvent power of all menstruums; they require more of the solvend to saturate them when aſsisted by heat, and, if they be in that state exposed to cold, they become weakened and over-saturated; the over-charge is, of consequence, separated. Let us apply this to our subject.

In cold and frosty winter days, the sun shining clear, we perceive about noon, large cities, and other moist places, when viewed at a distance, to be covered with thick and impenetrable mists. The solar heat, by increasing the action of the air, enables it to suspend a considerable quantity of vapour just over the surfaces of moist and damp places, but the coldneſs of the season prevents it from being diffused to any considerable distance. The intimate combination of the aqueous and aërial particles does not consequently take place; hence, the moisture being only in a state of diffusion, mists are formed.

But in a hot summer's day, when the sun is in its meridian height, no such mists are to be observed, though the proceſs of evaporation goes on with increased rapidity; the solvent power of the air being at such times so great as to produce an immediate combination; this being gradually leſsened as the sun declines, a precipitation ensues, and mists are formed.

These become more and more perceptible as the sun declines, and after sun-set grow exceedingly copious and thick, proportionate, *cæteris paribus,* to the heat of the preceding day; hence many tell you, that thick mists in summer nights foretel a hot day.

In many parts of the East-Indies, especially in places situated near the sea, the heat being altogether insupportable in the day-time, such a quantity of vapours are taken up, and consequently, so great an over-charge, when the solar heat leſsens, that the fogs in the night are so thick, as to interrupt all kind of commerce among the inhabitants, who are obliged at such times to keep their doors and windows as close as poſsible.

And it has been observed in Ruſsia, that in winter, when the north wind blows, the air is rendered too thick for respiration; such a plentiful precipitation taking place in consequence of the cold.

This over-charge, in frosty weather, when falling from a great height, forms snow in large flakes; if from that height, which in warmer seasons produces mizzling rains, it becomes sleet; but when only floating over the surface, the watery particles, too small to be visible, collect upon the ground and leaves of vegetables, and form hoar frost.

The solution of water in air is found to generate cold; this by weakening the action of the air as a menstruum, may, in some degree, help the precipitation of part of the solvend, and be thus a concurring cause of the mists hanging over most places in rainy weather.

This discovery enables us to account for the disagreeable chilly coldneſs which we feel in very damp or wet seasons, especially when snow is thawing upon the ground.

The Effect of the different State of the Air, as to Rarity and Density, upon its solvent Power.

The more dense the air is, the greater must its action be as a menstruum; for a greater quantity of it being at such times in a given space, more is applied to the solvent. The contrary of this must happen when its density is diminished.

Evaporation goes not on in vacuo, as I have mentioned in a former part of this eſsay.

This is rendered visible to us by means of the air-pump. For the air being rarefied in the receiver, a dew or mist is formed in it, and the water is, at length, seen trickling down the sides; the air being thus made leſs capable of sustaining the watery particles, becomes over-saturated within; the over-charge is consequently precipitated.

Does not this experiment show, that the action of heat is only, at the most, an aſsistant in the formation of vapours, not a neceſsary agent?

Thus thunder-storms, by which the density of the air is much diminished, are mostly followed by showers of rain. And the falling of the mercury in the barometer, prognosticates a similar precipitation.

The Separation of Water from the Air when combined intimately together.

We know that the air contains, at all times, and in every part, a certain quantity of water; and we suppose, a proper mixture, not a mechanical diffusion, to be the consequence of this combination.

No method has yet been hit upon to effect this separation. It may, perhaps, be done by the method used in separating other compound bodies, by elective attraction,

But this will be found very difficult, especially in such a manner as that the air, when entirely divested of its water, may be rendered capable of examination,

ESSAY XXI.

On the Improvement of Moſs Land.

MOSSES are of various kinds, but may be reduced to the two following: 1. Black or Peat Moſs; and 2. White or Flow Moſs.

The first, which is compoſed of the roots and fibres of heath, and other large vegetables, is more solid and tenacious than the white moſs, and in consequence, more improvable. It is generally used as peat for fuel.

The second retains a great quantity of water, is almost a fluid, and, when drained, is of a spongy light substance. In moſses of this sort, there is a stratum from three to twenty-four inches thick, of a light fungous substance, above the black peat, which, when cut for fuel, is laid aside, being incapable of making peat for burning. This sort of moſs is not so fit for improvement as the first, especially when this stratum is very thick, as it requires a longer time to consolidate, before the lime or other manures can operate upon it, and the first crops are not so certain, though in two years it becomes nearly as good as the other, and is improved to advantage. The moſses here are, in general, from eight to fourteen feet deep, and the succeſs in reclaiming them has been the same, whatever was their depth.

The first thing to be done, is to cut out proper main or master drains, in order to carry off the superfluous water, taking care to preserve the greatest poſsible level, which in every case that has yet occurred, has been easily obtained, and which drains can be, and are so constructed, as to divide the field into inclosures from six to ten Scots acres. If the moſs declines, the inclosures may be of any dimension whatever.

The dimensions of these drains, when first made, are eight feet wide at top, by four and a half feet deep, gradually contracting to two and a half feet at bottom, and cost at the rate of one shilling per fall of eighteen and a half feet, running measure. The ridges are then to be marked off regularly, six or seven yards broad, formed with the spade, in the manner following:

In the centre of each ridge, a space of about twenty inches is allowed to remain untouched, on each side of which a furrow is opened, and turned upon the untouched space, so as completely to cover it. Thus begun, the work is continued, by cutting with the spade, in width about twelve inches, and turning it over, to appearance as if done with a plough, until you come to the division-furrow, which should be two feet wide, cut out and thrown upon the sides of the ridges.

The depth of the division-furrow is to be regulated by circumstances, according as the moſs is wet or dry, but so as to answer the purpose of draining or bleeding the moſs, and conducting the water to the main drains.

It may here be observed, that the succeſs of the after-crops depends very much upon a proper formation of the ridges. They must not be made too high in the middle, for there they will be too dry for the lime to act; and near the furrows they will be too wet, which is equally prejudicial; they should therefore be constructed with a gentle declivity towards the furrows, so as the rain which falls may rather filtrate through the ridge to the furrows, than run quickly off the surface.

The operation of digging and forming the ridges has generally been done by contract, and where the surface is tolerably even or equal, it costs one pound thirteen shillings and fourpence per Scots acre, or twopence halfpenny per fall; but where it is in great holes, and wheel-barrows used, it costs from two pounds to two pounds two shillings per acre.

The next operation is to top-dreſs the ridges with lime, at the rate of from four to eight chaldrons per acre. Five Winchester bushels make a boll, and eight bolls a chaldron, of shell lime, producing sixteen bolls powdered lime, being the ordinary measure of lime in this district (Irish lime excepted, which is only four Winchester bushels); the quicker the lime is put on after being slaked the better. Coal and lime abound in the neighbourhood, and the prime cost of lime at the kilns, is one shilling and two-pence per boll, shells of five Winchester bushels.

The moſs is of a conſiderable extent, and a narrow ſuperficial road has been made through the middle of it, ſo as to admit ſingle horſe carts. A ſmall trench or drain is cut on both ſides of the road, and the road covered with gravel, or ſome hard ſubſtance, and ſeems to ſtand well. By this road the lime and dung is carried in ſingle-horſe carts, and put upon the ridge from planks, by wheelbarrows. The ſecond year after the main drains have been made, the ſides conſolidate ſo as to carry ſingle-horſe carts in ſummer, and the lime and dung is carried by them to the road; and the crops taken off in the ſame manner.

The proper ſeaſon to prepare the moſs for a firſt crop, is early the preceding ſummer; in that caſe the lime, aided by the heat, the after-rains, and the winter froſts, makes a conſiderable progreſs in the proceſs of putrefaction, conſequently forms a mould to receive the ſeed.

Oats are ſometimes ſown as a firſt crop, but they very often miſcarry the firſt year, and from what I ſaw, and was informed, never ought to be ſown where dung can at any expense be procured. Potatoes planted in what is called the lazy-bed way, ought to be the first crop. The method is simple, and attended with little expense. The moss prepared by ridges, and limed as before described, the potatoe-beds next spring are marked off, acroſs the ridges, five or six feet broad, with intermediate spaces of about two feet, as furrows or trenches. The beds are covered over with a thin stratum of dung, about eighteen single-horse carts to an acre; the cuttings of potatoes are laid or placed upon the beds, about ten or twelve inches asunder, and the whole covered over with a stratum of moſs, from the intermediate trenches, which is followed by another covering from the trenches, when the potatoe plants make their first appearance, the covering in whole four or five inches. In this state they remain without any hoeing till the crop is taken up. The produce never leſs than from forty to fifty bolls of excellent potatoes, eight Winchester bushels to the boll, and the bushel a little heaped.

When the potatoe crop is removed, the ridges are again formed as before described, and the division-furrow cleared out, which costs at the rate of 18s. per acre.

In performing this part of the work, it will naturally occur, that a greater part of the manured ſurface will be buried in filling up the trenches between the lazy beds; but that is not the caſe. The workman makes two cuts with the ſpade, at eighteen inches diſtance, upon the ſide of the trench; another one foot from the edge of it, as deep as the trench; which inſtead of turning over, he preſſes a foot forward into the trench, which is continued the length of it, and when he comes to the other ſide, he does the ſame, making both meet, and ſo proceeds; ſo that no part of the manured ſurface is thrown down, and the ridge left in the ſame form as before the lazy-beds were made.

It may be here remarked, that every operation done upon moſs by the ſpade, can be executed at the third of the expenſe, that would be requiſite on any the eaſieſt dry land.—Moſs is a light ſubſtance, ſufficiently tenacious, never ſticks to the ſpade, and requires no force to cut it, as it works as eaſy as a new-made cheeſe would. Any perſon who has ſeen moſſes dug for peats as fuel, will be convinced how quick, and with what facility it is done, even by labourers not accuſtomed to it.

When the potatoe crop is taken off, and the ridges formed, they remain in that state till spring, when oats are sown, (a wet or dry season, has from experience been found a matter of indifference) and harrowed in with a small harrow drawn by two men. Four men, with ease, harrow at least, one acre one rood per day, two and two by turns with the harrow, and the other two in the interim with spades, smoothing the inequalities, breaking and dividing the mould, and clearing out the division-furrows; which last, in all operations upon moſs, is eſsentially neceſsary. The early or hot-seed oats are always preferred for seed. The late, or cold-seed, runs too much to straw, and falls down, consequently the grain is of mean quality, and unproductive in meal.

Expenſe of improving an acre of Moſs.

Note—The acre in this account, is always meant the Scots acre, being nearly one-fifth larger than the English acre.

The average size of the inclosures is eight acres; to inclose which by the main drains, will require 143 falls, of eighteen and a half feet each, at 1s. per fall in proportion for one acre, 17¾ falls.	£.0	17	9
Digging and forming the ridges with the division-furrows, is from 1l. 13s. to 2l. 2s.	2	2	0
Prime cost lime for top-dreſsing one acre, 8 chaldrons, being 320 bushels, or 64 bolls, at 1s. 2d. per boll.	£.3	14	8
The distance here is from one mile to one mile and a half, 64 bolls may at a greater distance be carried for	0	10	0

Brought forward £.	2	19	9
Expense of 64 bolls of lime	4	4	8
Laying on the lime	0	8	0
Value of the dung, supposing it bought, laid down at the side of the field, 3s. per single horse-cart, 20 carts	3	0	0
Laying on the dung	0	8	0
Trenching lazy-beds for covering the potatoes	0	6	0
Three bolls of potatoes for seed at 8s.	1	4	0
Taking up the potatoes and carrying home	1	10	0
	14	0	5
Interest of £. 14 0 5d. for two years	1	8	0
Total expense	15	8	5
Produce of potatoes from 40 to 50 bolls, say 40 bolls, at 8s. per boll	16	0	0
Gain upon the first crop per acre	0	11	7

Second Year.

Reducing the lazy-beds into ridges	0	18	0
One boll of oats for seed	0	13	0
Four men harrow one acre per day at 1s. 6d. each	0	6	0
Reaping 6s.—Carrying off 2s. 6d.	0	8	6

Brought forward £.	2	5	6
Leading and stacking 2s. 6d.— Threshing 5s.	0	7	6
Dreſsing 1s.—Carrying to market 5s.	0	6	0
	2	19	0
Interest for one year	0	3	0
£.	3	2	0
Produce of 10 bolls per acre at 13s. £.6 10 0 Value of the straw 0 15 0	7	5	0
Gain on the second year £.	4	3	0

Third Year.

Digging the ridges	1	6	0
One boll of oats for seed	0	13	0
Harrowing 6s.—Reaping 6s.	0	12	0
Carrying off	0	2	6
Leading and stacking	0	2	6
Threshing 5s.—Dreſsing 1s.	0	6	0
Carrying to market	0	5	0
Clearing main-drains	0	1	0
	3	8	0
Interest for one year	0	3	4
Expenses third year £.	3	11	4

Produce 10 bolls of oats at 13s.	£.6	10	0			
Value of straw	0	15	0	£.7	5	0
Gain third year				£.3	13	8

Fourth Year.

By this time the moſs is so consolidated as to be ploughed by horses, within two bouts or stitches of the division-furrows, and the crop removed by carts.

Ploughing	0	6	0
Digging two spits, and clearing division furrows	0	4	0
One boll of oats for seed	0	13	0
Graſs seeds	1	0	0
Harrowing with horses 3s. Reaping 5s	0	8	0
Leading off and stacking	0	3	0
Threshing, &c.	0	3	0
Carrying to market	0	4	0
Cleaning main-drains	0	1	6
	3	2	6
Interest for one year	0	2	8
	3	5	2

Produce 6 bolls oats at 13s.	£.3	18	0			
Value of straw	0	8	0	4	6	0
Gain fourth year				£. 1	0	10

Fifth Year, Hay.

Cutting 3s.—Winning 3s.				0	6	0
Leading and stacking 5s.—Cleaning drains 1s.				0	6	0
				£.0	12	0
Produce of 200 stone of hay at 4d.	£. 3	6	8			
After-graſs	0	10	0	3	16	8
Gain the fifth year				£. 3	4	8

The moſs will now be sufficiently consolidated, and fit for pasture, and will let, as such, for 1l. 5s. per acre

Recapitulation.

Gain the first year	0	11	7
Second year	4	3	0
Third year	3	13	8
Fourth year	1	0	10
Fifth year	3	4	8
	£. 12	13	9

And will let for pasture at 1l. 5s. per acre.

The reclaiming of moſs upon this plan, bids fair to be of very great consequence, and when it becomes better known, will, from experience, suffer further improvement. There are many thousand acres of this sort of ground in Great Britain; situate in climates where corn thrives well; some in the very best corn countries, where lime, marl, or other calcarious matter can be obtained at a moderate expense; which appears to be what is most essentially neceſsary in this improvement; and much greater quantities of moſs abound in Ireland, none of which produces a penny per acre in its natural state. There is no danger of not obtaining a proper level, for in most large moſses a river runs through them, and were it otherwise, and that they had no level, they would in time become lakes.

There are no waste lands which can be improved with equal advantage as moſs; none will give so quick, or so large returns, or be so permanent.—Any person poſseſsed of moſs, and who may be desirous to make the experiment, should go himself, or send a man experienced in agriculture, to see the operations carried on at Swinridgemuir; and before he begins, endeavour to engage a labourer from that part of the country, who has been experienced in the buſineſs, which they perform with great ease and dexterity, and there is no doubt but his own people will soon get into the method. If that cannot be obtained, a labourer may be sent to work there a short time, which will answer the purpose equally well.

So large a quantity of lime as is before mentioned, perhaps is not neceſsary in this improvement; especially if only three crops of corn were taken before laying into graſs. Six chaldrons, or 240 bushels, shell lime, making 60 bolls of the measure sold at Lord Elgin's works; or 40 bolls of the Linlithgow measure, might be abundantly sufficient for one acre, and would have the same good effect as a larger quantity, especially where potatoes with dung are used for a first crop.

The calculations of the price of seed and labour, as also the price of the produce of the crops, are estimated at the prices in ordinary years. The land thus improved lies between Beith and Irwin in the County of Ayr, North Britain.

ESSAY XXII.

On Gathering Apples and Pears, and Preserving them.

AS apples shaken or beaten down with a pole never keep in winter, they ought all to be hand-picked by a person standing on steps made on purpose.

The steps should be light, for convenience of moving from one place to another, and so contrived, that the ladder may be disengaged from the back at pleasure, which may easily be done if they are fastened together by a bolt at top. There should be a broad step at top to stand on, with room for the basket which is to hold the fruit. When you begin to gather the fruit you should be provided with hand-baskets of different sizes, and also with large baskets or hampers, and wheelbarrows. You must lay some short graſs mowings, perfectly dry, (which you ought to provide for the purpose in summer, and keep in a shed or any other dry place till wanted) at the bottoms of the large baskets and hampers, to prevent the fruit from being bruised.

Observe attentively when the apples and pears are ripe, and do not pick them always at the same regular time of the year, as is the practice with many. A dry season will forward the ripening of fruit, and a wet one retard it, so that there will sometimes be a month or five weeks difference in the proper time of gathering. The method that I have practised is, to observe when the fruit begins to fall; I do not mean what we call wind-falls, or the falling of such as are infested with the caterpillars, &c. but sound fruit; I then put my hand under it; and if it comes off without any force being used, I take it for granted that the fruit is perfectly ripe; unleſs the tree be sickly, which is easily known by the leaves or fruit being shriveled. If the foregoing observations are attended to, the fruit will keep well, and be plump, and not shriveled, as is the case with all fruit that is gathered before it is ripe.

The person on the steps should pick the fruit carefully, and lay it gently into the basket on the top of the steps, for if it be in the least bruised it will not keep. For the same reason, great care must be taken in emptying the fruit out of the hand-baskets, when full, into the large baskets or hampers. If more than one large basket be wheeled at once, which may generally be done, the lower ones must not be so full as to let the bottom of the upper one touch the fruit; it will also be neceſsary to put some of the soft dry graſs between the baskets, and also over the fruit in the upper basket.

When the fruit begins to fall of itself, cover the ground under the tree with some of the short graſs mowings, or if that cannot be procured, with some pease-haulm, or oat or barley straw, quite dry; this will preserve the fruit from bruising when it drops: the fruit which thus falls of itself should be laid up separate from, and used before that which is hand-picked, according to the season in which they are fit to be sent to table. Should any be bruised by falling on one another, they should be thrown aside, as only fit for baking, or to be given to the pigs.

When all the fruit is gathered in, rake off the short graſs, &c. and throw it up to rot, or mix it with dung, or leaves of trees; for if it remain on the ground during the winter, it will harbour slugs.

When the bolt of the steps is taken out, and the ladder and back part separated, the ladder will then be fit to use in gathering fruit off wall trees; only it will be neceſsary to screw on the upper part of it two pieces of iron, or nail two pieces of ash or oak, about six or eight inches long, to keep it far enough from the wall to prevent the tree from sustaining any damage in the bark or branches, which would infallibly bring on the canker.

When the fruit is carried to the fruit room, lay some of the dry short graſs on the floor in the area of the room; then take the fruit gently out of the baskets, and lay it in heaps on the top of the graſs, keeping each sort in a separate heap; the heaps may be from two to three feet high, or according to the quantity of fruit that you have. When the heaps are completed, cover the tops at least two inches thick with short graſs, in order to sweat them. Let them lie a fortnight, then open the heaps and turn them over, wiping each apple or pear with a dry woollen cloth, which should be frequently dried during the proceſs, observing now to lay in the middle the fruit which before was at the top. Let the heaps now remain eight or ten days covered as before; by that time they will have thrown out the watery crudities which they may have imbibed during a wet season; then uncover the heaps and wipe the fruit carefully one by one as before, picking out every one that is injured, or has the least spot, as unfit for keeping.

Fruit should be gathered, if poſsible, in dry weather, and when the dew is exhaled from off the trees; and remember never to gather in the evening after the dew begins to fall.

During the time that the fruit is sweating, the windows should be left open, except in wet and foggy weather, to admit the air to carry off the moisture which perspires from the fruit. The perspiration will sometimes be so great, that on putting your hand into the heap, it will come out as wet as if it had been dipped into a pail of water: when in this state it will be neceſsary to turn and wipe the fruit.

In laying up fruit, the common practice has been to lay it on clean wheat straw, but I find, by experience, that when any of the fruit begins to decay, if it be not immediately picked out, the straw, by imbibing the moisture from the decayed fruit, will become tainted, and communicate a disagreeable taste to the sound fruit.

I would likewise caution those who erect new shelves in their fruit rooms, to have the timber well seasoned, and to make use of white deal in preference to red, as the latter, especially if not very well seasoned, is apt to give a very disagreeable resinous taste to the fruit, which quite spoils it flavour. I would therefore recommend covering the bottoms of the shelves with thin coarse canvas, (such as may be purchased for about eight or tenpence a yard) on which the fruit should be laid in a single layer, after being wiped perfectly dry; but by no means lay them a top of one another. When that is done cover them with a piece of the same canvas, or thin flannel, or with old newspapers, or whitish brown paper, which will, in a great measure, exclude the air, prevent the frost from injuring the fruit, and preserve a beautiful smoothneſs on its skin. The fruit should be turned two or three times during the winter; as delicate and tender fruit, by laying long without turning, is apt to rot on the underside, even if perfectly sound when laid up. Be particularly careful, however, to pick out all the damaged fruit.

When the fruit is laid in, put the earliest sorts on the lower shelves, or in the lower drawers, according to their time of coming in, beginning with the Nonesuch, Golden Rennet, and Jenneting Apples, and Bergamot and Beurré Pears; (for I find by experience that the Jargonelle keeps best on the tree, as, if gathered, it rots almost immediately;) thus, by proper management, you may have a constant succeſsion of fruit from one season to the other.

When there are large quantities of fruit, it will require a great deal of time to lay it on the shelves, &c.: this buſineſs may therefore be done in wet weather, or in the evenings, when you cannot conveniently spare your men from the out-door work in the day-time.

Those who keep their fruit in storehouses, for the supply of the London and other markets, as well as those who have not proper fruit-rooms, may keep their apples and pears in baskets or hampers; putting some soft paper in the bottoms and round the edges of the baskets &c. to keep the fruit from being bruised; then put in a layer of fruit, and over that another layer of paper, and so on, a layer of fruit and of paper alternately, till the basket or hamper be full: cover the top with paper three or four times double, to exclude the air and froſt as much as poſsible. Every different sort of fruit should be packed separately; and it will be proper to fix a label to each basket or hamper, with the name of the fruit that it contains, and the time of its being fit for use.

But the best way of keeping fruit is, to pack it in glazed earthen jars. The pears or apples must be separately wrapped up in soft paper, then put a little well dried bran in the bottom of the jar, and over the bran a layer of fruit, then a little more bran to fill up the interstices between the fruit, and to cover it; and so on, a layer of fruit and of bran alternately, till the jar be full; then shake it gently, which will make the fruit and bran sink a little; fill up the vacancy at top with more bran, and lay some paper over it, covering the top with a piece of bladder, to exclude the air; then put on the top or cover of the jar, observing that it fits as closely as poſsible. These jars should be kept in a room where you can have a fire in wet or damp weather.

If fruit be to be sent to any considerable distance, great care should be taken in packing it, which should not be in baskets, as they are liable to be bruised among heavy luggage, and the fruit of course will be injured. I would therefore, recommend boxes made of strong deal, of different sizes, according to the quantity of fruit to be packed. The following are the dimensions of the boxes in which we send fruit by the coach to Windsor and Weymouth, for the use of his Majesty and the Royal Family: viz. the larger box is two feet long, fourteen inches broad, and the same in depth; the smaller box is one foot nine inches long, one foot broad, and the same deep.—These boxes are made of inch deal, and well secured with three iron clamps at each corner; they have two small iron handles, one at each end, by which they are fastened to the roof of the coach: in these boxes we send melons, currants, pears, peaches, nectarines, plums, and grapes, packed so as always to have the heaviest fruit at bottem. The melons are wrapped up in soft paper; the pears, peaches, nectarines, plums, and grapes, are first wrapped up in vine-leaves, and then in paper; the cherries and currants are packed in a flat tin box one foot four inches long, two inches broad, and four deep.

In packing, proceed thus:—First put a

layer of fine long dry moſs in the bottom of the tin box, then a layer of currants, or cherries, then another layer of moſs; and so on alternately, fruit and moſs, until the box is so full, that when the lid is hasped down, the fruit may be so firmly packed as to preserve them from friction.

Make a layer of fine moſs and short soft dry graſs, well mixed, in the bottom of the deal box; then pack in the melons with some of the same, packing it tight in between all the rows, and also between the melons in the same row, till you have finished the layer; choosing the fruit as nearly of a size as poſsible, filling up every interstice with the moſs and graſs. When the melons are packed, lay a thin layer of moſs and graſs over them, upon which place the tin box with the currants, packing it firmly all round with moſs to prevent it from shaking; then put a thin layer of moſs over the box, and pack the pears firmly (but so as not to bruise them) on that layer, in the same manner as the melons; and so on with the peaches, nectarines, plums, and lastly, the grapes, filling up the box with moſs, that the lid may shut down so tight as to prevent any friction among the fruit. The boxes should have locks and two keys which may serve for them all; each of the persons who pack and unpack the fruit having a key.

The moſs and graſs should always be returned in the boxes, which, with a little addition, will serve the whole season, being shaken up and well aired after each journey, and keeping it sweet and clean. After the wooden box is locked, it will be neceſsary to cord it firmly.

My reason for being so particular on packing of fruit is, that I have known instances of its being totally spoiled in the carriage from improper packing.

By pursuing the above method we have never failed of succeſs; and if fruit be packed according to the foregoing directions, it may be sent to the farthest parts of the kingdom, by coaches, or waggons, with perfect safety.

ESSAY XXIII.

On the Natural History of Fiſhes.

NO branch of natural hiſtory is leſs known than that which reſpects the inſtincts, habitudes, and peculiarities of fiſhes: nor is this much to be wondered at; for, the element which they inhabit is ſo circumſtanced, as to prevent man from being able to follow them in their ſecret haunts, and there to obſerve their modes of procedure with regard to the ordinary functions of animal life. Even birds, which are much more palpable to our ſenſes in moving through their natural element, the air, cannot on many occaſions, have the progreſs in their larger migrations diſtinctly traced; but fiſhes can, not only in this reſpect, but many others, ſo eaſily withdraw themſelves beyond the influence of human power, that it is no wonder if we ſhould be but imperfectly acquainted with the circumſtances that effect them.

We know enough of them, however, to be ſenſible, that in regard to their natural inſtincts and habitudes, the different kinds of fishes vary very much from each other; perhaps as much as the various classes of terrestrial animals. Some kinds, like man, seem to be dispersed pretty equally throughout all parts of the world: while others are solely confined to particular regions: some may be said to be of a solitary nature, like the heron among birds, which is seldom seen to aſsociate with others of its kind in great numbers; while others are never to be found but in multitudes: some continue nearly stationary in one place at all times; while others seem to be wandering perpetually from place to place, and never fix in any one station for a continuance of time: some, though they continually frequent the same haunts, and never depart far from their native spot, yet change their stations within these limits, at certain fixed seasons, with the most steady regularity; while others, though they show a similar predilection for a certain spot for a number of years, where they make their appearance with tolerable regularity at certain seasons, will afterwards abandon these haunts, so as never afterwards to be seen there for many years together. With regard to the causes of some of these phænomena we can form plausible conjectures; while in respect to others, we are totally unable to give the slightest gueſs at the circumstances that should produce these variations. We are nearly as much at a loſs with regard to many other particulars affecting this claſs of animals.

Respecting the longevity of fishes, from reasoning we might be induced to conjecture that it was not intended by nature that the duration of their lives should be fixed to such a short space of time, nor the expansion of size to such narrow limits, as that of terrestrial animals; for the bones of fishes are so much of a cartilaginous nature, as to admit of being expanded by a natural increment for a much greater number of years than the harder bones of land animals, which soon attain a consistence that does not admit of any expansion; and there are a few facts, pretty well ascertained, which seem to confirm this conjecture. In the royal ponds at Marli, in France, there are some fishes that have been preserved tame since the time, I believe, of Francis the First, and which have been individually known to the persons who have had charge of them ever since that time; these have now attained a size much beyond the common bulk of fishes of the same kind; and, though there are certain peculiarities that distinguish them from younger fishes, yet they give no indication of that decrepitude and disease which are the inevitable accompaniments of a life protracted much beyond the usual period among quadrupeds. It is well known also, that fishermen sometimes catch an individual fish of more than double the size of what is reckoned a full-sized fish of that species, especially in those situations where they have been more strictly guarded from danger than is common. Carp and eels of immense size are sometimes caught in ponds that have been carefully secured from common depredators, and at the same time neglected by the owners, for a great number of years; which great size may be justly ascribed to the great age of the individuals: nor is there danger that the old fishes in such situations will be starved by the multitude of younger ones increasing so much as to deprive them of food; for, on whatever food the small fry may subsist, it seems to have been intended by Providence, that the larger should never want food while the smaller are beside them; for fishes in general, are observed to prey upon other fishes of any kind that are of a size to be swallowed by them; so that, for the most part, the small fry, even of the same species, become the food of those of larger size.

It has been long a *disideratum* among naturalists, to determine what is the food of plants? This question becomes peculiarly interesting, because it seemed at the same time to indicate, that if that could be ascertained, it would discover what was the food of animals; for all the animals that live upon the earth or in the air, are known, in general, to derive their subsistence either from vegetable food directly, by consuming vegetable substances themselves, or indirectly, by using the flesh of other animals which have ultimately derived their subsistence from vegetables. Hence it is, that we have invariably inferred, that even those animals which we call carnivorous, even those which are so purely such as never to taste any kind of vegetable food whatever, are still ultimately supported by vegetables; so that the substance, whatever it be, which constitutes the food of plants, must ultimately constitute the food of terrestrial animals also: Of course, the number of animals that can be subsisted on this globe can never exceed the quantity of vegetable matter that the earth can be made to produce for their subsistence, if the sea, and the food that can be drawn from thence, be put out of view.

But when we come to consider the sea, and other bodies of water that are accumulated on this earth, the same question occurs, though it aſsumes a very different shape. That there are vegetables in the sea, and in fresh waters every where, there can be no doubt; and that these vegetables may furnish food for particular animals, will not be denied; but it will be at the same time admitted, that the number of fishes, properly so called, that live chiefly upon vegetable matter are very few; and if there be any that live entirely upon it, they are not known by me. Fishes, by most naturalists, are conceived to be usually carnivorous, though many of them are not so entirely such, as not to consume certain kinds of vegetable matters when they come within their reach: and, although most fishes eat flies and terrestrial worms when they come in their way; yet the quantities of fishes that swarm in the immeasurable waste of waters that surround this globe are so immense, that the subsistence which they could derive from these sources appears to be so small as to be altogether disproportioned to their wants. In short, fishes of a smaller size seem to constitute the principal food of nearly all the fishes that we know. But the question still recurs here, as in regard to vegetables, what is it that constitutes the food of these small fry on which the larger subsist? For, if these are in the continual act of being consumed, as vegetables are by animals, they themselves must draw their subsistence from something that is not of an organised nature, as vegetables do. What then is this?

That vegetables extract from water the unorganised matter, whatever it may be, that by the vegetative proceſs is converted into vegetable substances, is universally admitted by all who have adverted to this subject; and that fishes, under certain circumstances at least, extract from water also an unorganised matter, which by an animal proceſs, equally unknown to us as the vegetable proceſs above alluded to, is converted into an animal substance, it seems scarcely poſsible to deny. This may indeed, appear at first sight, to those who have not adverted to subjects of this sort, a very untenable position; but why? Merely because such persons have been accustomed to believe, that nothing but palpably solid substances can furnish a suitable subsistence for animals of any kind. They have been accustomed to see the creatures with which they are acquainted invariably stand in need of solid substances for food; and they thence conclude, that nothing else can yield this subsistence.—But if vegetable solids derive their origin from unorganised fluids by the vegetative proceſs, what greater wonder would it be if an unorganised body, in a state of fluidity, should be converted into an animal substance by the animal proceſs? Indeed, we can as little conceive an idea of the manner in which an organised vegetable should, by the animal proceſs, be converted into an animal substance, as we can conceive the other; we only know that the last is so, because we see it done every day of our lives. We see more: we see that the very same vegetable is not only converted into animal substance in general, but into a variety of particular animal substances, each extremely different in form and other qualities, without our being able to to form the most distant conjecture how these things should be. The same kind of graſs for example, given to a pig, a calf, a lamb, a foal, and a gosling, will be capable of furnishing alone subsistence to them all, till each of them attains a state of maturity; and it is now found, that it has been, by the animal proceſs, changed from graſs into the various substances of flesh, skin, hair, wool, feathers, excrements, &c. which constitute the distinct animals of a boar, bull, ram, horse, and goose, each perfectly distinct from the other in all its peculiarities, and capable of continuing its kind distinct for ever, though they should all be subsisted upon the very same food to the end of time. That these things are so, we know; but why they are so, we know not, any more than the animals themselves do, whose natural organs perform, unknown to them, the functions that are neceſsary for producing these changes.

Let us, then, be no longer disposed to deny that fishes may be naturally endowed with the faculty of converting unorganised matter, that may at this moment subsist under a fluid form, into solid animal substances, because we cannot tell how this should be. We, in fact, know nothing of the economy of nature; we are only capable of observing a few of the visible effects of that economy, and the phænomena that result from these in certain circumstances. We know well, that a leech may be preserved alive and in health for a great length of time in common water, and that it will increase in size, and be capable of exercising all its animal functions in that state. It would be hard to deny that the leech had in this instance derived nourishment from the fluid alone, in which it lives, though it is at the same time well known that it greedily sucks up another fluid of animal origin when it can have accefs to that, from which we cannot doubt but it derives nourishment. In like manner the gold and silver fishes from China, may be kept in a vefsel of pure water for an indefinite length of time, without any other food than what they derive from that element; and during this period augment in size, and develope all their natural peculiarities; though they will greedily devour crumbs of bread, or various other kinds of food, if these chance to be thrown to them.

From these, and many other similar facts that might be stated, I can see no reason to doubt that fishes in general are endowed, by the economy of their natural organization, with the faculty of deriving sustenance from mere water, in the same manner as terrestrial animals are endowed with the faculty of deriving sustenance from vegetables; and though, in both cases, there may be some kinds which cannot be at all subsisted upon this original *pabulum* in its native state (those that are purely carnivorous), and many that admit of taking that *pabulum* partly in its native and partly in its prepared state (as man), yet that in both cases this original pabulum must be considered as constituting, either directly or indirectly, the food of the whole; so that the flesh of all terrestrial animals may be considered as being produced from vegetable matter changed by the animal proceſs into its present state. In like manner the flesh of all fishes may be considered as being water (or some diaphanous matter administered through the medium of water) converted by the animal economy into the flesh of fishes; and also that vegetable substances derive their nourishment from something administered to them in a similar manner through the medium of water.

To such persons as have never turned their minds towards disquisitions of this sort, it may appear, perhaps, a little difficult to admit that it is poſsible for a thin diaphanous fluid to be by any proceſs of nature converted into an opaque solid body of any kind, whether of a vegetable or animal nature; but their wonder in this case arises merely from their not having been in the habit of observing the phænomena of nature with a sufficient degree of attention; for such changes of fluid into solid bodies are extremely common. Ice, no one will deny, is a solid body, that we all know was a fluid in the usual state of our atmosphere. Both the solid and the fluid are in this case, it is true, diaphanous; so that we think the change is very inconsiderable. Tallow, when melted, is also a fluid, that is, in a great measure, diaphanous; but when it is allowed to cool it becomes a solid opaque body. Those substances called metals are solid in the usual temperature in which we live, but may be converted into fluids by a mere change of temperature. Even all these substances may be rendered elastic fluids, so as under certain circumstances to become invisible, and elude our senses.

In the above instances we see, that by natural procefses, which are every moment pafsing around us, diaphanous, elastic, imperceptable fluids are undergoing changes which render them solid, opaque, and ponderous bodies; and which as being common, appear to us in no respect surprising. Why, then, should similar changes, by the ministration of other natural operations, appear in our eyes surprising? Merely because we have not been in the habit of adverting to them.

Fluids are converted into solids by many other proceſses with which we are familiar, without any change of temperature, as happens to be the case in all the instances above adduced. All saline crystals contain water, not in a frozen state congealed by cold, but as a body, in the producing of which heat is often employed as a powerful agent. Common salt, and nitre are of this number; water, in both cases, constituting a very considerable portion of the whole maſs. These salts are transparent, though a considerable portion of the constituent matter of which they consist, is a solid opaque substance. Green vitriol (copperas) is in like manner a salt whose basis is iron, and alum a chrystal whose basis is clay, both opaque substances, as every one knows, along with which a great proportion of water is combined, the whole constituting a solid diaphanous body.

In these instances we see that opaque solid bodies become divested of their opacity, though they still retain their solid state; but the instances in which bodies lose at the same time their opacity and solidity, and become transparent fluids, are numerous, and so familiar to us, that we take no notice of them. Sugar, a solid opaque body, we every day diſsolve in water, when it disappears without disturbing the transparency of the fluid. Metals are, in like manner, dissolved in acids; and chalk, by a similar proceſs, loses its earthy form, and is changed into a fluid of crystalline purity. Into this transparent fluid let fall a drop of another fluid equally transparent (sulphuric acid), and the chalk instantly aſsumes its solid form, falling to the bottom in a white opaque maſs. Thus are solids and fluids, opacity and transparency, mutually convertible into each other by proceſses that are quite common.

These are familiar illustrations merely calculated to free from ridicule, in the minds of such of my readers as have not been in the habit of reflecting on things of this nature, the proposition announced. In none of these instances are *permanently elastic fluids*, which only of late have been suspected to enter as constituent parts into the composition of solid bodies, taken into the account. The modifications of which these light and invisible substances are susceptible, and the changes which they can be made to undergo by their various combinations with each other, are such as to appear altogether inconceivable by men who have been accustomed to overlook all substances that are not visible or tangible, or perceptible by the common application of our senses. In consequence of late discoveries, however, nothing is now leſs surprising than to see a solid weighty body produced, as it were, from nothing; that is, from the combination of two or more fluids that are, perhaps, not at all cognisable by our senses. Water itself is known to be a combination of that sort, which may be either made or destroyed at pleasure. That inanimate objects extract from the atmosphere alone, in some cases, an elastic invisible fluid which becomes fixed, and furnishes a considerable portion of the solid body itself, was proved above thirty years ago by a set of judicious experiments conducted by the ingenious Dr. Black, late of Edinburgh, which showed, by the most incontestible evidence, that nearly one-third part of marble or chalk, in their natural state, consists of such an elastic fluid thus fixed, to which at that time he gave the name of *fixed air*. The same substance, now called carbonic acid gas, is known at this time to enter as a constituent part into the composition of many other substances, and to be an active agent both in the animal and vegetable proceſses. From a multiplicity of experiments upon this and a variety of other aëriform fluids, there is no reason to doubt that most of the substances with which we are acquainted, consists of nothing else than these aëriform fluids fixed by certain proceſses of nature, (which can, indeed, *on some* occasions, be imitated by us) and variously combined, so as to aſsume the appearances which they now exhibit to our senses.

Since, then, we find, that by the agency of the elements alone, mere aëriform fluids, which, in the eyes of the multitude are deemed nothing, can be converted into solid substances of a variety of kinds, why should we be startled at believing, that by the vegetable and animal proceſses, the same imperceptible substances should be capable of being converted into the animal and vegetable matters that we see? This gives a striking view of the wonderful simplicity of that economy of nature which, the more we know of it, the more it must excite our admiration of the supreme First Cause whose fiat alone could constitute a Universe, which, under an infinity of never-ceasing changes, continues for ever the same. All animal and vegetable substances are ultimately resolved into aëriform fluids, which, when thus disengaged, become anew the source of new existences of the same sort.

Although I conclude then that fishes, perhaps of every sort, derive *some* part of their sustenance from water itself, yet there seems to be no reason to doubt that some sorts derive a much greater proportion of their food from it than others do. Of all the swimming fishes known to man as an article of food, I conceive that no one subsists so entirely on water as the herring. There is little reason, indeed, as I think, to doubt, but that herrings derive their subsistence from water, nearly as much so as vegetables in general do. The herring, it is known, is a fish of such a strong gregarious tendency, that it is always found in shoals; and on many occasions the herrings in these shoals are crowded so close together as to fill the whole sea from top to bottom, or at least so far as our implements can reach, so as to thicken the water with their bodies. Ships are said to have been retarded in their course in paſsing through these shoals; and on many occasions the herrings may be laded up in buckets in great quantities: frequent instances have also been known, where these little fishes have been left by the ebbing of the tide in heaps three feet deep upon the shores for many miles in extent at one time. Nor is it only upon rare occasions that such quantities of theſe fishes are collected together; they are seldom seen but in compacted shoals of this kind; and it is universally believed among those who are versant in this kind of fishery, that no other kind will voluntarily go into the middle of such a shoal. The whale, who preys upon them as his favourite food, and who will lick up, perhaps, a thousand at a mouthful, never allows himself to get into the shoal, but hovers about the skirts of it only, following their course wherever they go. The same thing is remarkable of the dog-fish, a species of shark of a voracious kind, which in great multitudes follow the herrings aſsiduously, but carefully keep aloof from the main body of them: so it is with regard to the cod and ling, all of which delight in the herring as a prey, but seem to dread their multitudes as a body.

That herrings derive the whole of their subsistence directly from water, in which they swim, seems to be confirmed by a multitude of facts respecting the habits and economy of that singular and deservedly celebrated little animal. Though they always swim in shoals of immense magnitude, which cannot be likened to any other phænomenon in nature with which we are acquainted, unleſs it be those destructive swarms of locusts which have been sometimes known to fill the air in certain regions of the globe, so as even to obscure the sight of the sun, and cover with their bodies every terrestrial object they meet with in their course; yet, unleſs it be with respect to *numbers*, we can find no other resemblance between the shoals of herrings and the locusts.—These insects proceed in their course evidently in search of food alone. The foremost of this multitude seize upon the first vegetables that come in their way, and devour it, leaving those that follow to perish, for want of food. Their course is marked by destruction; nothing is left behind to support animal existence. If the wind should chance then to shift, so as to drive them back in the same track through which they came, their subsistence being exhausted, they all perish: they are therefore in a continued state of progreſsion; and to rest in one place for a few days, or to return in their former path, are alike inevitable destruction to them: not so with the herrings. They advance sometimes with great rapidity, and sometimes more slowly: at times they recede, then perhaps advance in their former course; often they remain stationary in one place for whole months together. Neither do these motions appear to be in any degree influenced by the nature of their food; nor have any symptoms ever been discovered that their food has been diminished in consequence of their long continuance in one place. No circumstance respecting their migrations has ever been observed to have the smallest connexion with their condition in regard to fatneſs, or the reverse. When they are in a progreſs, let it be continued ever so long, the foremost fishes in the shoal have not been observed to be in a better condition than those in the rear, which must have been the case had they preyed on small fry, or drawn their subsistence from any other solid substances that floated in the water; neither has it been observed that they generally get leaner after they have remained long in one place; which must have been the case had they subsisted on the solid substances contained in the water, which in that case must have been quickly devoured. That a body of herrings, however, is sometimes found, the individuals of which are in general much fatter or leaner, larger or smaller than others, is certain; but if these two different sorts are found in the same place, it as often happens that the fat fiſh follow the lean, as the reverse. There is, in short, no connexion observable between these two circumstances; so that no known fact seems to give the smallest indication that ever the quantity of food has been, in any respect, exhausted, or even diminished by the numbers or long continuance of this fish in one station. All these facts seem decisively to indicate, that this creature is capable of drawing its subsistence from the water itself by an inherent power of its animal functions, of converting sea water, or the elements of which it consists, into its own substance, which nutrimentitious matter it would seem always to find in abundance wherever that water exists.

This reasoning is strongly confirmed by the facts observable respecting its condition when the body of this little fish is examined. Wherever a herring has been caught, or under whatever circumstances it has been killed, if it be in good health, and consequently fat and in good condition, nothing is ever found in its stomach that gives the smallest indication that it has been either of vegetable or animal origin. The only contents of the stomach is a very small quantity of a mucous matter of a slimy nature *sui generis*, that has no parallel that I know of in the world. Under the influence of one peculiar disease indeed, when the fish is in a state of exhaustion that renders it totally unfit for any of the purposes for which the herring is ever caught by man, some vestiges of small fishes are found in its stomach, as is usual with other fish; but this false appetite has evidently been the consequence of disease, as it is never observed but under these circumstances. It seems to be produced in the same manner as the desire to eat pieces of mortar or lime rubbish is found irresistibly to prevail among some children, when they are distreſsed by that disease which is occasioned by worms in the body.

From all these facts combined, it would seem that it had been intended by nature, that the herring should be endowed with the faculty of deriving its nourishment directly from water, nearly in the same manner as vegetables derive their subsistence from the same element in the soil, in order that an abundant sustenance might thus be furnished to other fishes that are of a nature more strictly carnivorous than it is. That other fishes, especially those which multiply very fast, may be endowed with a similar faculty in a greater or leſser degree, seems to be extremely probable; by means of which the water becomes capable of nourishing immense multitudes of fishes, which, were we able to examine it at all depths, might probably be found to support a much greater proportion of animal matter, than the land itself, with all the plants that grow upon it, are capable of subsisting.

That fishes migrate on some occasions, as birds do, we well know; but with the causes of these migrations we are in a great measure unacquainted. We are too much strangers to the economy of these creatures even to gueſs, on most occasions, at the circumstances that may influence their conduct. In general we are disposed to believe, that the movements of animals are chiefly influenced by the want of food, in quest of which their lives are chiefly employed; but that this is not always, at least, the reason why fishes change their place of abode we know, from what we have been enabled to observe with respect to the salmon, which, being more within our reach than most other fishes, has had the circumstances affecting it more particularly investigated.

The salmon is one of the few fishes which, though it can live equally well in salt or in fresh water for a time, cannot exist without a frequent change from the one to the other; hence it happens that salmon are found in the sea only in the neighbourhood of some river; nor do they abide long in any river without going into the sea, from which they soon return, and again re-mount the river. Their progreſs in these peregrinations has been remarked by fishermen; and all the devices of the latter are calculated to arrest them in that progreſs. Beside those irregular movements which seem to affect individuals only throughout the greatest part of the season, the following changes in their progreſs have been remarked as regular and periodical.

About the month of October, the salmon, then in full roe, when the season of spawning approaches, directed by an invariable instinct, leaving the deeper waters where they usually subsist, push forward into rills and shoals, where they deposit their spawn, over which the attendant male sheds his milt. They then aſsist each other in returning the sand and gravel into the part that they had hollowed out for the reception of the spawn. After this they return, in a feeble and exhausted condition, to their former haunts, where they gradually attain greater strength, and in time come into better condition, so as in due season to become proper food for man, when he again resumes his suspended labours in search of them for food.

The spawn, fostered by the influence of the season, is in due time brought into life, and the young fry after a while begin, like their parents, to direct their progreſs towards the sea, near to which they usually arrive about the month of May, and towards which they then hasten. At this period of time they are from four to six inches in length only, being in some places called *smoults*. After a time the *smoults* totally disappear from the rivers. They are at this time gone into the sea, from whence they return in the month of June or July. They are then prodigiously augmented in size, being from sixteen to twenty inches, or more, in length, and of proportionate bulk; so that they weigh six or ten times more than before. Their flesh has by this time acquired the reddish hue and peculiar taste of the salmon, which it had not before, and they are then called *grilses*. The augmentation of size in such a short period of time, and the other changes that have taken place, are so great, that it is no wonder that many persons should doubt whether these are the same kind of fish; but their identity has been ascertained by experiments often repeated. Many gentlemen, who live upon the banks of rivers where salmon abound, have amused themselves by catching smoults in their descent, and marking numbers of them by cutting their fins in a particular manner, or fastening braſs rings in them in such a way as not to admit of being easily disentangled, and then putting them into the water: many of which fishes have been again caught, at the distance of five or six weeks from that time, in the state of grilses; so that no doubt of their identity could be entertained.

It will be unneceſsary, and indeed impoſsible in our present state of knowledge, to trace the future progreſs of the salmon minutely. Like other fishes, they continue to increase in size, probably, as long as they live; insomuch that there are instances of some individuals having been caught that have weighed a hundred pounds weight; at least ten times the size at which they are in a state to produce young. These are, no doubt, individuals which have fortunately escaped, far longer than their brethren, the perils that continually await them.

One circumstance only affecting this fish has been noticed, which seems to account for the neceſsity that they feel themselves under, so frequently to change their place of abode between the fresh and the salt water (for they never seem to experience a want of provisions in either;) it is this: when a salmon has continued for a considerable time in fresh water, a particular insect, or louse, is observed to fix upon it, especially about the gills; where they increase very fast, so as to become extremely numerous and distreſsful to it. There appears to be no other remedy for this disease, but the going into salt water, where this insect cannot subsist; so that the fish becomes perfectly clean and healthy in a short time after it has entered into that element: but it has not been there long before it becomes infested with another species of louse, which cannot exist in fresh water; so that the salmon is forced to return once more into the river, in order to get rid of it. In this way the poor creature is impelled by neceſsity frequently to change between these two elements; but these changes take place respecting the fishes individually, and do not affect the whole aggregate body at one time; so that it does not occur periodically at regular seasons.

The above explanation is given, not in consequence of my own observations (for I have had no opportunity of making them,) but on the authority of a gentleman of veracity who has long attended to this subject himself, and has had the best opportunities of ascertaining facts from the information of many fishermen who have been engaged in that busineſs for twenty or thirty years, and on whose joint tesimony, corroborating his own observations, he relies. Be this, however, as it may, the certainty is, that the salmon is so much under the neceſsity of paſsing frequently from salt to fresh water, and the reverse, that it has been found, that in whatever river salmon have been bred, these identical salmon are observed never to desert that river, and enter into another, unleſs when the mouths of the two rivers are extremely near to each other; and it thus happens that in many cases the salmon of one river have qualities and peculiarities that clearly distinguish them from those of the other; which separate qualities, the salmon of each river may poſseſs perhaps for ages without alteration. The practical inferences that may be drawn from these facts are obvious, and of great importance. There is, every season, the difference of more than a month between the time that the fisheries begin in the rivers Don and Ythan, both in Aberdeenshire, though the mouths of these two rivers are not more than twelve miles distant from each other.

There is one other peculiarity respecting the salmon, which, as it seems to be in some measure connected with its migrations, deserves to be taken notice of here. It is observed, that those salmon which are caught in the great fresh water lake called *Loch-neſs* are never out of season; so that they may be caught and used at that time of the year when the killing of salmon is by law prohibited in most other places. May not this peculiarity be occasioned by the following circumstance? Nature directs those fishes that are in roe, and about to spawn, (when they are always lean and out of condition) to leave the deep waters and search for shallow places, in which their spawn may be safely deposited. But it is probable, that it is such fish only as are in that condition, which feel the influence of that instinct. It is, by no means, improbable, that among fishes, as among other animals, some individuals may miſs having young at the usual season. If so, these individuals will not feel the instinctive impulse that makes them leave the deep water; they may, therefore, choose to continue there when the others abandon it for shallow streams; they ought then also to be in good condition; and, as they are then abandoned by the whole of their sickly companions, all that can be caught at that season there should be in good condition. If so, other lakes may certainly be found that are similarly circumstanced, in which the salmon are also good at that season of the year; and I know, in fact, that there are other places where salmon continue good at the prohibited season; but not knowing the very places I cannot examine particulars. If my conjecture be well founded, the salmon caught there at the prohibited season should never be in roe, or at least not near spawning. Is it so? Neither ought healthy fish to be at that season obtained without an intermixture of sickly ones, unleſs it be in large bodies of *deep* water, for where shallow water can be found near the edges, some of the sickly fish may remain there to deposit their spawn; so that they cannot be separated from the others: of course the general law could admit of no exception in regard to such places, should it even happen that a considerable number of sound fish should be there at the time.

There is one other fish, nearly as common as the salmon in this country, that is migratory also, when in a situation to admit of it; but to which the neceſsity of these migrations is not such as to be indispensable; this is the *eel*. Eels, we know, can live and breed in stagnant ponds from which there is no outlet, as carp and tench, and several other fishes do; but whether they ever there attain the same perfection as under other circumstances, may perhaps admit of a doubt. In what place the eel deposits its young in preference to others, when it is at perfect freedom, I know not: or whether the young fry make a progreſsion towards the sea, as the salmon does at a certain period of its growth, I cannot tell. But this I know, from my own observation in one particular case, and I know that it has been observed by others in similar circumstances, that in the month of June in each year, immense swarms of young eels make a progreſs from the lower part of the river towards the higher, with a quickneſs and unremitted aſsiduity that is very surprising. I had occasion to remark this phænomenon in the river Dee in Aberdeenshire, where local circumstances, perhaps, contributed to render that peculiarity perceptible there, which may very easily be unobserved while it is paſsing with equal regularity in other places. The eel is a fish that seems (unlike the trout) to dislike running streams, and therefore avoids that part of the river where the current is strong. It had, probably, been this circumstance that induced them, in the rapid river Dee, totally to abandon the middle channel, and to direct their progreſs only along the edges of the river close to the banks: and it was probably the transparency of the water, and its ſhallowneſs at the edge, that enabled me to mark this phænomenon, which seemed to me not a little curious.

Having occasion at one time to walk frequently upon the banks of that river for several days together, I could not help observing a black kind of mark that ran along the edge of the river in an uninterrupted line wherever I went, very like the dark mark left by water on many occasions along the margin of pools where the bottom is gravel; which line followed the bends and windings of the river, being often suddenly turned aside by stones or other interruptions without any breach of its continuity. This line had frequently caught my eye, without attracting particular notice; till one time that I came to a projecting point round which the current was brisker than usual; at this place I perceived a kind of vibratory motion in the line; and on looking closer, I observed something like the wriggling of an animal, making efforts to stem the current. I stooped down, and put my hand into the water to touch the line, with a view to examine what it was: the line became discontinued when my hand approached it, and I could touch nothing of it; but it united again as soon as my hand was withdrawn. This induced me to examine it very nearly; and I then perceived, to my no small astonishment, that this line was formed by an uninterrupted series of small eels, moving forward with great celerity, exactly in the same manner as a long file of soldiers might march without interruption. These eels did not (as nearly as I can recollect) exceed half an inch in length, but were in all respects perfectly formed like the common eel. The line might perhaps, on an average, consist of from twenty to thirty in breadth, and the individuals being in different degrees of forwardneſs, and close to each other, made the line uniform without any thing like links or breaks of any sort. I observed them with great attention for a long time; and am convinced that they advanced with a progreſs of not leſs than four miles an hour. This progreſs continued, without interruption night or day, for eight days together that I remained at that place: how much longer it continued, I had no opportunity of learning; but there was no apparent diminution of it when I left the place. I croſsed the river on purpose to observe whether there was a similar line there, and found it in all respects the same. The water in which they floated at the place where I observed them was in general about two or three inches deep. I did not then think of going to a still deeper part of the river, which I might have found at a few miles distance; and I now much regret that I did not; as I think it probable that I should there have lost sight of them; for there they might have been dispersed more equally through the whole body of the river, and could not, of course, have been observed, especially if the water was deep, with a dark muddy bottom. It is probable, that in this manner the migration of eels, which I am satisfied must take place to a much greater extent in many other rivers, has been so little observed.

From the data above stated, it is easy to compute that the numbers which must have thus paſsed, amounted to many myriads. What becomes of such multitudes of fishes we may conjecture, but never perhaps shall be able to ascertain.

The above observations respect the spontaneous movements of eels *upwards* in rivers; those that follow give indications of a similar progreſs *downwards* at one season of the year by the same species of fishes. There is in Scotland, in the neighbourhood of Linlithgow, a pretty considerable lake, commonly called in that country *Linlithgow-loch* in which great quantities of eels are caught. These may be taken by hooks and lines during any of the summer months; but the principal fishing is in the month of October; at which time it is found, that the eels, directed by natural instinct, discover an irresistible propensity to iſsue from the loch by the paſsage through which the water flows from it to the sea. At that season of the year, then, the person who rents the fisheries of the loch, puts into that paſsage a kind of box, or chest, that is so formed as to allow free paſsage to the water, while it stops those eels that exceed a certain size. This kind of chest is every morning emptied of its fish, which are there found in such abundance as to require sometimes to be carried off in carts. The fishing season continues about a month; before or after which time few or none can be taken in that way; so that the chest is then removed, and the paſsage left free.

In Wiltshire also a similar practice prevails, by which great quantities of eels are taken every year. About Warminster, where the rivers are small, and more rapid in their course than in many other parts of England, the mills placed on the streams are pretty numerous, and the water is carefully directed into one channel. The persons poſseſsing these mills having found by long experience, that a great number of fine eels go down the river during every flood that happens about the beginning of October each year, have devised a kind of box, or chest, similar to the above, which they call an eel-grate; this they then place in a convenient part of the river, and thus great quantities of eels are caught, which they dispose of to very good account. But they find also, that no eels worth mentioning can be taken in this way at any other season of the year.

Whether the eels that are thus caught in descending the river are near the breeding time, as the salmon are which ascend the small streams, has not been ascertained; probably they are: but if so, they are not like the salmon, then lean and out of condition, but fat and full, as haddocks are in January, when they are in full roe. It is probable, that these eels deposit their young somewhere near the mouths of the rivers. That these large eels ascend the rivers again at another season of the year till they regain their former haunts, there is room, from reason and analogy, to suppose; but their progreſs in this respect has not, that I know of, been remarked by any one. This circumstance appears to me in no respect surprising; because the same facilities do not take place for discovering them in their progreſs upward, were it even certain, as for that in their descent. In the latter case, they are precipitated by the current into situations where they cannot so easily make there escape, and thus elude the attention of observers, as may happen in their ascending progreſs. They may have been at first entangled in their descent in baskets or nets whose mouths were placed towards the current. This could not be done in their ascending progreſs; and although devices called *cruives* have been invented for catching salmon in ascending the rivers; yet, the progreſs of eels in that direction having not been remarked, no contrivance that I have heard of for thus catching *them* has been devised. It ought also to be remembered, that the current, when the rivers are swelled, must force them forward at those periods in which they are now observed in much greater numbers than at any other, so as to render them then conspicuous; whereas, in mounting the river, their progreſs, by being more equally divided through a longer period of time, must be leſs perceptible.

In confirmation of the opinion, that this progreſs may hitherto have escaped notice merely from our not having adverted to it, I may be allowed to remark, that, although there is reason to believe that there is not a river in the kingdom, especially such as derive their origin from marshes or extensive lakes, in which the eels at the regular season do not descend the river; yet unleſs it be in the two cases above designed, which are so similar in kind, though separated at such a distance as to leave no room to suspect that the practices there adopted have been communicated from the one to the other, a similar progreſs of this fish has never been remarked. For my own part, I have not a doubt, from the above stated facts, that a similar progreſs in all cases must take place under similar circumstances; and I am firmly convinced, that by attending to these facts with care, and adopting the arrangements that reason will suggest on such occasions, many beneficial fisheries of this sort may be established in situations where hitherto nothing of the kind has ever been deemed poſsible.

It is perhaps unneceſsary to remark, that if the large eels do indeed return, it might be poſsible, by watching the time of their progreſs, to devise contrivances for stopping them in their ascent somewhat similar to the construction of *cruives* for salmon, which might be done at a very triffling expense, upon those small rills especially that communicate with swamps or lakes; for though the banks were overflowed during floods, yet if these eel-traps occupied the full width of the rill, when in its usual state, no loſs could be sustained during floods; as the strength of the current would at that time interrupt their progreſs upwards. It is very probable also, that if the large eels do indeed return, they may do it more leisurely than they descend, especially where the water runs dead. It is therefore, in brisk running streams that we shall most likely be able to discover the circumstances that affect these migrations.

It may be proper also to remark, that if my conjecture respecting the periodical migrations of this kind of fish be well founded, and general, it ought to follow, that fewer eels should be found in those lakes where the water as it iſsues from them falls over a steep rock, forming a deep cascade, than in others where the communication with the sea is more free;

because, though the eels might be precipitated over it in their descent, the young fry would be there interrupted in their attempts to ascend over it. Exactly such is the case with Loch-schin, a large fresh water lake in the shire of Sutherland in Scotland. Can any of my readers inform me whether eels abound in that lake or not, and whether those that are there found are in any respects distinguishable from others? I ask not if there be *any* eels in it; for that there will be *some*, I have no doubt; but the question is, are there as *many* as in similar lakes, below which there is no steep cascade?

The migrations of herrings, though the knowledge of them would be of much greater consequence to man than that of either of the former, are still leſs understood than those are. With regard to the fishes already noticed, though our information be but small, our judgment in respect to them has not been misled by false intelligence; so that, although we have much to learn, we have nothing to unlearn: not so with regard to herrings; for though our knowledge respecting them be indeed extremely limited, yet every person who has but glanced at the subject, believes that he has a thorough knowledge of every particular respecting the migration of this interesting little fish, however imperfect his information may be respecting other particulars affecting it. Yet I am not, in fact, aware of any circumstance respecting the natural history of the herring that is involved in such obscurity as that of its emigrations; so that we have much to unlearn before we can begin our search after useful information: and nothing aſsuredly can tend so much to retard our progreſs in any research as the neceſsity of this kind of retrograde motion, which is so unpleasing to the feelings of man in general, that many persons will rather choose to continue in delusion than make the neceſsary efforts to free themselves from its influence.

What renders the case particularly hopeleſs in the present instance is, the beautiful simplicity of the system that has been invented respecting this matter, the length of time that it has been received by all the literary world as an acknowledged truth, and the high authorities (if great names shall be admitted as such) that may be adduced in support of it. Yet, in spite of all these authorities, it will not be difficult, I imagine, to show, that well ascertained facts so evidently contradict that system, as of neceſsity to compel the attentive inquirer, whatever reluctance he may feel on the occasion, entirely to abandon the hypothesis as untenable, whatever difficulty he may find in divising another that shall prove satisfactory: but as error, he knows, must at all events be abandoned, before truth can be discovered, he has no other alternative than to follow that course.

Who the person was that first published the popular account of the migration of herrings, I have not yet been able to learn; but that it was admitted as a true account before the year 1550, when Guicciardini wrote his *Descrittione de paesi baſsi*, is certain; for he there distinctly details it as such in nearly the same terms in which it is now described; and it has been copied from him, or his authorities, by all the writers that have since treated of the herring fishery, with scarcely a single exception, and without the smallest indication of doubt as to any particular respecting it being giving by any of them. The outlines of this system are as follow:

The great receptacle of herrings, according to this account the *officina gentium*, or grand store-house, from which the whole world is supplied with herrings, is the great Northern Ocean. In this unexplored retreat, they are said to be accumulated in immense multitudes during the early part of each year; from whence there iſsues forth annually about the end of May, or beginning of June (much as it would seem, after the same manner as a swarm of bees iſsue from the parent hive), an immense swarm of herrings, which, proceeding in a compacted body in a southern direction, gradually fill all the southern seas that lie in the course of their progreſs. This immense swarm or shoal of herrings (as it is technically called) have, according to this account, proceeded so far in their course as to reach the islands of Shetland toward or before the middle of June. Here these islands, opposing their progreſs, compel the herrings to separate; one body of the fish proceeds forward along the eastern shores of these islands, which in their progreſs fill all the lochs [*loch* means here a narrow arm of the sea breaking into the land, such are Loch-urn, Loch-duich, and all the other lochs in the west Highlands] and bays on the western coasts of the continent, the Baltic being included among the number. Part of these still go forward, from which are detached small shoals which appear in the bays on the eastern coast of Scotland. Still proceeding forward, they at length reach the coast of Norfolk about the beginning of October, where the fishers of Yarmouth then find them; but, what is singularly remarkable, none have ever been found on the opposite coasts of Holland. The great body of the fish being by this time much divided, they proceed only in small numbers to the southward; and coasting round the southern shores of Britain, they finally unite with their brethren, which had separated from them at Shetland, about the Lands End of Cornwall, near the beginning of winter.

Part of the shoal which went along the western coasts of Shetland, soon meeting the Orkney islands, there fill all the bays on these coasts that they encounter: the chief body, still proceeding to the west of these islands, at last meet the northern parts of Scotland and the western isles, and are thus forced once more to divide, one part continuing their progreſs between the main land and the western islands, the other going along to the westward of these islands, filling the bays of these coasts in their progreſs. They thus paſs on between the main land and the Isle of Man, a detachment proceeding at the same time along the west coasts of Ireland; till, finally, the remains of these two divisions join their long-lost companions about the coasts of Cornwall, where they disappear, and return as well as they can, but nobody knows how, to their original habitation in the Northern Ocean, to be ready at the appointed time to set out anew in their annual progreſs.

Such, in few words, are the outlines of the tale that has been told, and gravely repeated, as undeniable facts, by all our writers for three hundred years past. No doubt, such a tale is well calculated to catch the minds of the multitude; for it has so much of the wonderful as cannot fail to operate powerfully on their imaginations; but one would conceive that this very circumstance should have induced philosophers to suspect that there might be some fallacy in it, and thus have induced them to compare and examine the facts on which it is said to rest, and thus to establish, without doubt, either its truth or its fallacy. I cannot, however, find that this has been done by any one; so that the task, thus late, has at last fallen to my share.

I myself, like most of those, I presume, who shall read this, for a great many years of my life relied with the most unsuspecting confidence upon the truth of this tale in all its parts; conceiving that so many men of the most respectable talents, could not have propagated it with such steadineſs without having examined it with attention. In this state of mind I entered upon a survey of the fisheries on the coast of Scotland in the year 1784.—But my embarraſsment was great, when on conversing with actual fishermen, who had long followed that employment as a busineſs, instead of meeting with that beautiful arrangement that I expected, I found myself involved in a chaos of contradictory facts, which could in no way be brought to quadrate with the above hypothesis; and the ineffectual efforts I made to reconcile these, involved my mind for a time in the utmost perplexity and confusion. To free myself from this embarraſsing situation, I resolved to set aside all idea of hypothesis or system of any kind, and to attend to facts only as they occured; and, having carefully ascertained them, enter them in my minutes with the most scrupulous fidelity. Even the fishermen themselves, I found, had been embarraſsed in the same way as I was; so that when they attempted to give a connected view of the procedure which they ought to follow, it would in general have led to a conduct extremely different from that which they found themselves under the necessity of adhering to in practice; thus it required a steady attention to discriminate between the direction they gave as a rule of conduct, and the procedure they actually did adopt in the prosecution of their buſineſs; the last of which I marked with care, and the first was with equal caution totally neglected: nor was it till after a very careful collation of the facts thus obtained, that the fallacy of this long-lived hypothesis became clearly apparent. These facts I threw together in an Appendix to the report that I presented to the Committee of Parliament, on the Northern Fisheries, anno 1785, that has been since published in the account of the Hebrides, Appendix, No. 2, to which the curious reader, who wants full information on this subject, is referred. The few facts that follow will be sufficient, on the present occasion, to show the fallacy of that hypothesis.

If the hypothesis above stated had been well founded, the fishing for herrings in all the

European seas ought to begin first in the most northerly parts, and gradually extend to the southward; but how do facts in this respect stand? Although much irregularity prevails with respect to the time when the fishery commences on different parts of the coast; yet there is in some cases a sort of order observable, which, though not invariably steady, is neverthelefs, on an average of years, pretty uniform. In this sense then it may be said, that the earliest herring fisheries on the coasts of Britain, are those on the coast of the Isle of Man, and in Loch-fine.* Herrings on an average of seasons, are caught in these two places two months (often three months) before a single herring can be observed on any of the coasts of Scotland, or the Isles from Cape Wrath to the Mull of Cantyre; though it is obvious, by inspection of the map, that, had the hypothesis been just, the fiſhes could not have got to either of these places without having first paſsed Cape Wrath, and all the other places between that and the Mull of Cantyre. How then, it may be asked, should it so happen, that nine years out of ten they are first seen in these two southern stations?

Again: few herrings are in general to be found on the Orkney coast, where they should, by the hypothesis, abound in immense multitudes in the month of June; yet, instead of this, it is seldom that a single herring can be there caught at that season of the year; and the few herrings that can be there caught are taken only during the winter months, long after they should have deserted those seas.

Again: by the hypothesis we should expect that the herrings in their progreſs southward, in the month of June, when the north coast of Scotland, from Cape Wrath to Thurso, opposed their progreſs, could not fail to be then pushed in immense multitudes into all the creeks and bays on this coast. The fact, however, is, that scarcely any herrings can be there caught; and the few that are there found are chiefly caught in winter. The same observations apply to the Murray Firth, in which, toward Inverneſs, a few herrings sometimes may be found, and still more during late years on the east coast of Caithneſs; but here also the principal fishing season is winter, when they ought long to have abandoned that coast. It deserves also to be remarked, that, although the Dutch, from the conveniency and safety of Braſsay sound in Shetland, have established that station as a general rendezvous for their buſses, from whence they are to take their departure on the 26th of June, to prosecute the fisheries during the ensuing season wherever they shall find it most convenient; yet the herring fishery that the natives occasionally follow on that coast, is not in the summer, but in the winter season. It deserves farther to be remarked, that on the coast of Sweden, not much to the southward of Shetland, the herring fishery never commences till toward the month of December.

It has been already stated, that the supposed progreſs of the herrings southward is at such a rate as that they reach Yarmouth about the month of October; and this fact has been deemed the most undeniable proof of the truth of the hypothesis. But though it be admitted, that the herring fishery begins with as much regularity at Yarmouth in the month of October, as it does at the Isle of Man and Loch-fine in the month of June; yet these two facts, so clearly contradicting each other, only tend to show the groundleſsneſs of that hypothesis: more especially when connected with those that have been already stated; to which I beg leave to add the following. About eight or nine years ago, a large body of herrings was discovered in the Frith of Forth above Leith in the month of November, where they continued in great numbers till the month of February. They have made their appearance in the same place, and nearly at the same season, every year since that time, though they have never been discovered there till more than a month after the Yarmouth fisheries, so much south of them, were at the best, and had begun to decline.

Finally, to conclude this branch of our subject: the herring fisheries on the coasts of Hampshire, in the south of England, usually take place in the month of October, at the very same time with that at Yarmouth, both which fishings are ended some time in November; whereas in the narrow seas, within reach of the London market, it is well known, that herrings are caught occasionally, and sold in the streets of London, in the months of November, December, January, February, March, April, and May; but chiefly in this last month, when there is scarcely a year occurs in which they are not to be found there in abundance; at which time, according to the hypothesis, they should be all far to the northward of Shetland.

From these facts, to which might be added many more were it deemed neceſsary, it is evident, that the account of the migrations of herrings above quoted is entirely hypothetical, and is clearly contradicted by the most undeniable evidence; so that it ought to be abandoned as erroneous and chimerical.

That herrings, however, do shift from place to place occasionally, and keep together for the most part in great bodies called shoals, is an undeniable fact; but what the causes of these migrations are, or whither they go when they withdraw from our sight, remains yet to be discovered. The following facts and observations, tending to lead to an elucidation of this circumstance, deserves consideration, because, whatever tends to develope the truth, must at the same time augment the knowledge and extend the powers of man.

The above stated facts, and all others known respecting herrings, tend not to give the smallest indication of any large and regular progreſs of the whole body in any one direction whatever at regular periods of the year. We find them at the same season of the year at Dronthein and the Isle of Man, at Caithneſs and the Isle of Wight, at Stockholm and at London. This might naturally lead us to suspect, that the herrings, when they retired from our view, went to much shorter distances than has been supposed; and that those which appear occasionally on different coasts are not in fact the same body of fish, but distinct and separate shoals that have no neceſsary connexion with each other, but may retain their station nearly throughout the whole year. Haddocks, we know, are caught upon many coasts; yet no one ever took it into his head to believe that the haddocks which are caught on the Norfolk coast are the same body of fish, or ever intermixed with those that are caught on the shores of Aberdeen. Why then should we suppose that the herrings on the Norfolk coast are the identical fish that are seen in Shetland?

That haddocks as well as herrings do sometimes, from causes unknown to us, leave their usual haunt, and retire we know not whither, is made evident by the following fact, which is in the recollection of thousands of persons who may read this. About ten or twelve years ago, haddocks disappeared all along the south-east coasts of Scotland, insomuch that one fish of this sort could not be there caught where hundreds used to be taken. This scarcity continued there for the space of six or seven years nearly, when that kind of fish again unexpectedly returned to those shores in as great abundance as formerly: and, what is not a little remarkable, it was observed that those which did return were of a much larger size than those that went away. Whither these haddocks retired during the time they were absent, no one knows. It only seems probable that they had merely withdrawn themselves from the coast till they were beyond the reach of the fishermen; for had they gone to another part of the coast it must have been observed by the increased numbers there, which was in no case perceptible.

It seems to me extremely probable, that herrings, as well as haddocks, do not in general depart far from their native place, and that they never, at any season of the year, abandon entirely any of those seas on the shores of which they have been usually discovered in great quantities; but that, impelled by some instinct or natural want, they at certain seasons approach the shore, or rise near to the surface of the water, so as to come within the reach of man, from whence they occasionally withdraw themselves into deep water, where they lie concealed from us. Upon this supposition all the facts above stated, and every other fact respecting the herring that has come to my knowledge, perfectly harmonize.

We have it in our power to adduce some facts in support of this hypothesis even stronger than any of those already mentioned. There are many and strong indications that there are different *breeds* of herrings, as well as of cattle, sheep, and other domestic animals, which may be distinguished from each other by characteristical marks plainly perceptible; and which, from the strong gregarious nature of this fish, can be traced distinctly for a greater length of time, and through a greater variety of circumstances, than perhaps any other kind of fish whatever.

The first hint of any thing of this sort I ever met with, was among the practical fishermen, who had in no sort generalized their notions on this subject, but who spoke as decisively of the Loch-fine or Isle of Man herrings, and others, and seemed to have as clear an idea of the distinctions between them, as a grazier in England would speak of the Leicester, Lincolnshire, and South-down sheep. From these persons, however, I could draw no decisive information, for their descriptions were so vague that they conveyed no precise idea; and my mind had not yet got into the track to enable me to make any clear arrangements. It was not till I fell in with Mr. Macdonell of Barrasdale, a man of strong understanding, whose employment [bailiff of the herring fisheries, a kind of local superintendant to preserve order among the fishermen on the coasts of Scotland] obliged him to attend particularly to the herring fishery, and the circumstances affecting it throughout his whole life. It is to him that I am indebted for the facts that enabled me at last to perceive a ray of light that gave some indications that the impenetrable gloom in which this subject has been hitherto enveloped, may be at last diſsipated,

Mr. Macdonell discriminated the different breeds of herrings that were in his own neighbourhood with much greater accuracy than any of the others I had conversed with, insomuch that he could not only point them out at once when showed to him, but could even mention their distinctive marks, which he gave me in writing to the following effect. "The herrings of this loch (Loch-urn) and Loch-duich, [in its vicinity to the northward] I mean the home-bred ones, are short, their bellies prominent, their backs thick and rather hollow, or bending inwards about the middle of it, than straight; and, as the herrings of both bays seem to be the same, when they leave Loch-duich [during the season they frequent the shores] they generally cast up here. Those of Loch-nevish [to the southward] have more of the salmon shape, are stronger, and have large black and full eyes. Those of Loch-nanuach [farther southward still] have something that distinguish them from both." How often do we find that a skilful eye can mark a perceptible difference where no words can be invented to convey an idea of it? The jeweller can thus distinguish a false from a true brilliant, where another person could recognise no difference: nor could he give any idea to another how this can be done.

Mr. Macdonell, taking it for granted that the shoal of fish which frequented the same haunts for years together had been bred there, always denominates them home-bred fish, when he wants to distinguish them from any foreign shoal of herrings that may accidently intermix with them, which frequently is the case, and which is to be expected; for no boundaries can be there fixed to confine them. "Sometimes, he observes, these foreign fish come into the bay that does not belong to them, and the native herrings themselves sometimes make a turn elsewhere, but usually return again;" though there are no doubt occasions in which they may go so far as to lose their path, and never return any more; these wanderers taking up their residence at last in some suitable situation, where perhaps no herrings before were known, which they make their home, and leave it not for years, perhaps for ages. What follows is a slight sketch of some progreſsions of this sort that had been remarked by the same gentleman. He thus proceeds:

"About eleven years ago [this was written anno 1784] says he, a very large shoal of foreign fish appeared at Gare-loch [east from the north point of the Isle of Skye] about the beginning of August. Their course was from the north southward, and in their progreſs filled all the lochs [bays] as far southward as Loch-duich [about 40 miles.] A small branch of it came into this loch, [Loch-urn, about 8 miles more] continued in it five days, and then disappeared, carrying with them a small body of home-bred fish they found in the loch. They continued, however, longer in the bays to the northward, then retired to the offing, when they returned to these bays; I mean, to the northern ones, and to those on the north and east of Skye, where they remained until the beginning of January. In this way they continued to make their appearance, early and late, for five years, or until the whole body of them were perhaps destroyed; *nor did I hear, nor do I think that this shoal ever removed farther to the* southward or westward. It is remarkable, *that the home-bred fish were all along distinguishable from them.* Since that time no considerable shoal of *foreign* fish appeared in my district; though now and then a few, probably the remains of the great shoal, were distinguishable among the home-bred fish.

" In the year 1753, he proceeds, a very large shoal of foreign fish came into Lochbroom, and the bays in its neighbourhood, in winter. They continued their visits for three or four years; then slackened. Soon after they appeared in Barra, in winter likewise. They continued a year or two, and then made off. The winter following they came into the bays on the west side of Skye in immense quantities, and continued to return regularly every October or November till the year 1765, and afterwards in smaller bodies till 1768, when they entirely vanished."

From these facts combined I can see no reason to doubt that, instead of the whole maſs of herrings that are any where found in our seas being one individual shoal, which, being all bred in one place, and proceeding in a regular course, only separate for a time as circumstances direct, and afterwards unite at one season, that they may set out anew in their annual circuit, and therefore must, of course, be all of one individual kind, they are in reality a variety of kinds of fish of the same species, which have been originally bred in different parts of the sea; and, being of a nature strongly gregarious, they continue to frequent nearly the same original haunts to which they have from their infancy been habituated, and only accidentally at times intermingle with other sorts: that although they choose in general to abide near their native shores, yet they are impelled by some natural propensity, of the cause of which we are ignorant, to make occasional transitions from place to place: that in regard to these transitions, though they are confined to no particular season of the year if the herrings in general be considered, yet if the particular breeds or shoals only be adverted to, a certain sort of regularity is observable in this respect, so that they return to the same place nearly at the same season one year as at another; and that when any great body of them have once fixed on a station, they usually continue to frequent it for a great many years. It often happens, however, that, after having continued for a great length of time to frequent one station, they sometimes abandon it entirely, even for ages together, without being seen there at all; but whither they retire when they make their short disappearance, or where they go when they withdraw entirely from a particular station, is not known, but remains for future investigation. That the particulars above stated accord better with well-known facts respecting the herring fishery than any other hypothesis that has ever been offered to the public, will, I think, be easy to prove: and, if it be so, certain practical corollaries may be deduced from it that may be of considerable utility in the prosecution of that fishery in future, so that it well deserves to be particularly investigated.

Enough has been already said to invalidate the notion of the great annual migration of herrings, and of their retiring to the polar regions in winter to breed. That they do breed in all the seas in which they have ever been found, admits of the most decisive evidence; for there is scarcely a take of herrings any where in which there are not to be found individual fishes in all their stages of gestation; some in full roe, some lately delivered only, or *shotten* as they are called, and others having a roe only beginning to be formed. This is so evidently the case, that the Dutch, who have bestowed more attention on the herring fishery than any other nation, and attained to the greatest perfection yet known in curing that kind of fish, have considered it as an object worthy of legislative regulation. Accordingly we find, that in all their placarts for this purpose, it is expreſsly ordained, that all the herrings caught shall be carefully examined and separated into three sorts, viz. the prime herrings, those of an inferior quality, and the *shotten* herrings (which are the worst, and cannot be offered for sale without a mark to distinguish them as such): nor can there be a doubt that the superior excellence of the Dutch herrings is in a great measure to be attributed to this sorting, which is neglected by other nations. Every fisherman where herrings are caught recognises, it is true, the same distinction, and readily admits the fact, that *shotten* herrings are to be found every where, and at every season of the year, whereever herrings are caught, though they are also aware that there are at some times a much greater proportion of them in this state than at others. It is therefore an undeniable fact, that herrings are bred in all the seas in which this fish is to be found, and at every season of the year.

It is, however, at the same time admitted (as has been just stated) that a much greater proportion of them are in that state at one particular season in certain districts than at other seasons. At some times nine out of ten nearly will be found in this state, and sometimes not one in a score; and which deserves to be particularly remarked, this does not occur always at the same time of the year. Sometimes a body of herrings will be found, alike at an early or late season, which are almost entirely in this debilitated state; while at the very same time another body of herrings will be found at no great diſtance from them, that have very few ſhotten among them: but, if the ſame body of fiſh have continued in one haunt very long, it may be obſerved, that in regard to theſe fiſh, a much greater number of them may be found to be in that ſtate (ſhotten) generally at one ſeaſon than at others. For inſtance, I have been aſſured, by a perſon who has paid a good deal of attention to the herring fiſhery on the coaſt of Hampſhire, that before the end of October few ſhotten herrings are taken there; but if the fiſhing continue after that ſeaſon, many more are found in that ſtate, on which account the fiſhing there is then uſually diſcontinued; whereas on the coaſt of Sweden, in the Frith of Forth of late years, on the coaſt of Caithneſs, and in many other of the lochs on the weſt coaſts of Scotland and Ireland, the fiſheries are uſually only beginning in November or December, and continue through the months of January and February. Nay, it ſometimes happens, that in theſe lochs, a body of fiſh which are moſt of them in a lean foul ſtate (ſhotten) will deſert it, and be ſucceeded by another ſhoal, which is in the moſt perfectly ſound ſtate. This affords to me a moſt deciſive proof that there are distinct and separate breeds of herrings, as there are of any other animals.

That the herring, however, has a natural propensity to withdraw itself from the shores, or to retire from the surface of the water towards the bottom, about the time of spawning, seems to me probable from the circumstance of its being found by experience, that the greatest proportion of the fish that are caught in our seas are in their sound state, unleſs it be perhaps in some particular cases where they are forcibly detained longer than they might be naturally inclined to remain; such as on the coast of Sweden, where it is the custom to surround a whole body of fish with a very long net, having the two ends of the net joined to the shore, and then taking them out with smaller nets within this kind of inclosure In such situations they may be forcibly retained a long while, so that many of them may be caught in that state. What the fact is with regard to this particular in Sweden, I have had no opportunity of being informed.

That herrings continue all the winter in the sea near those coasts where they are usually caught, is rendered probable from the experience of the fishermen at Drontheim in Norway, who can catch them, and actually do catch them as bait, at all seasons; and by the fishermen in Loch-fine in Scotland, who invariably aſsert that they are in that sea at all times, though they are too deep at certain seasons to be within reach of their nets; and, as it is well known, that the herring never takes any bait, they never can be caught by lines. But the fishermen in Loch-fine positively aſsert, that their lines for catching other fish are often covered with the spawn of the herrings. A probable way of discovering whether the herrings do actually continue in our seas might be, to examine the stomachs of the larger fish that are caught, such as codling, hake, &c. though this cannot afford a *certain* criterion, as these kinds of fish are well known only to frequent shallow banks in the sea; whereas the herrings, when they are about to breed, may seek the deepest waters only for the purpose of depositing their spawn, or for other reasons. Cod are found on banks from 10 to 40 fathoms deep; ling from 20 to 200 fathoms; but seldom are they looked for at these great depths. If future observations shall prove it to be a truth, that the herring naturally retires to deep water to deposit its spawn, and only approaches the surface, or draws near to the shores, when the greatest part of the shoal are in their soundest state of health, we shall indeed have reason to admire the bounty of Providence, which hath implanted that propensity, which brings this little fish so opportunely within the reach of human power; nor will the remark of Guicciardini on this subject appear to be extravagant: "Ma par' veramente," says he, "che questi pesci, per pascer' l'huomo dalla natura sieno mandati: perche se ne vengono propinqui al litto del mare, a presentarsi, et principalmente corrono a musare, dove elle veggono fuoco, o lume, o creature humane, quasi dicendo pigliami, pigliami." That is: "But it would indeed seem, that this fish had been ordained by nature as food for man; because it comes near to the shore to recreate itself wherever it sees fire, or light, or human beings; saying, as it were, 'Take me, take me.'" If it be considered, that this fish lives chiefly, if not wholly, on the element of water, and thus furnishes food to innumerable other fishes, which minister so abundantly to human nourishment, and which require food of a substantial nature, it will not then be denied that the herring has been destined to perform a very important part in the economy of the universe: and may not the law of nature, by which it is induced to retire to great depths to deposit its spawn (if it be really so) where the young fry, by being beyond the depth that suits its most voracious devourers, may live in comparative safety till they have attained the age that makes them feel the impulse which induces them to rise to the surface, be a principal cause of the immensity of those multitudes which then fill the seas near their native haunts, and furnish such an abundant repast for myriads of creatures who are then continually in pursuit of them! Among these enemies, the whale is the most conspicuous, and the cod fish, perhaps, the most numerous; nor do I think it unreasonable to suppose, that where these voracious creatures are found in great numbers, some variety of the herring tribe may be looked for: but enough has been said on this branch of the subject. These hints are merely suggested as subjects for future investigation.

The locality of the herring, if this phrase shall be admitted, may be also considered as a collateral proof that the different shoals which appear at different stations with great regularity for many years together, are each of them a distinct body of fish, that have no regular communication or connexion with each other, and therefore may be distinct varieties of fish that have peculiarities which, if carefully investigated, might serve to discriminate them from each other. We know, from the evidence of undoubted historical records, that many centuries ago herrings were caught every year in great abundance in the Baltic; and that for a long period of time, this was deemed one of the best stations for the herring fisheries. It can scarcely be supposed, that at that period these herrings went regularly to the northern ocean at one season of the year, from whence they invariably returned to the Baltic; for more than two hundred years not a single herring has been caught in that sea. Is it not, therefore, very probable, that this body of herrings, which had for so many years remained at all seasons in that narrow sea, having by by some accidental cause found their way out of the strait, had gone somewhere else; never having been able to find their way back again? In like manner we know, that of late years immense quantities of herrings have been caught on the Swedish coast near Gothenburg, where no fish of that sort were ever seen in ancient times. How long they will continue on that station, the records of future times must show. Thus also it is known, that Loch-broom was the most distinguished station for the herring fishery on the west coasts of Scotland, and continued so for many years, though of late it has been scarcely distinguishable from other stations on that coast. The Yarmouth herring fishery has continued for a great period of years, as also those near the Isle of Man, and in Loch-fine; though at no period, so far as I can learn, were these fishings ever so abundant as some others. While the herrings have continued to be caught in these places for a great number of years with a comparative degree of steadineſs, the herring fisheries on other parts of the coasts have been subjected to great variations. A very considerable herring fishery was carried on with great steadineſs, about the month of August annually, for the space of fifty years or more, before and after the year 1700, on the south-east coast of Fife, where scarcely a single fish of that sort has been seen for upwards of fifty years past; and it has been already remarked, that for about ten years past an abundant herring fishery has been carried on every year from the month of November to February or March, in the Frith of Forth, higher up than Edinburgh, where no herrings were ever known to have been seen before that time. I might enumerate many other facts of the same kind; but this would only prove tiresome; these, I hope, will be deemed enough to show that it is highly probable, that each particular shoal or great body of herrings that are discoverable any where, is a distinct breed of fish that has peculiar qualities and habits which distinguish it from others: that among these peculiarities a disposition to retain the same station, and make its appearance at a particular season of the year, is one of the most distinguishable; and that when these peculiarities are once ascertained, a recurrence of the same phænomena may be looked for with some degree of certainty for several years; but that no absolute dependence can ever be had on its continuing for any fixed period of time, far leſs that they will never abandon those haunts in which they have long delighted. Influenced by these considerations, I ventured to advise the fishermen on the Frith of Forth, when the herrings first so unexpectedly made their appearance there in a large body, and when these fishermen were in great doubt whether they should make any preparations for their return the ensuing season, by all means to avail themselves of the opportunity that their departure afforded, to make preparations for their return; as the probability was very great that they would return not only the next year, but for many succeeding years with much regularity about the same season of the year. The fact has since proved that my reasoning was right, and they have been benefited by the advice. No man, therefore, ought to look upon disquisitions of this sort as idle speculations: were they more carefully investigated than they have been, they might lead to very useful conclusions.

I hope this will be admitted as a sufficient apology for my adding one farther hint on this subject before I leave it, and which I suggest merely with a view to stimulate to more accurate investigation; it is this: Since it seems probable, that different shoals of herrings are distinct breeds which propagate their kind with a certain degree of regularity, as breeds of other animals do, is it not reasonable to suppose, that distinct breeds may poſseſs peculiar qualities which may render them more valuable than others, or the reverse, for particular purposes? And, if so, may not this peculiarity be the cause of certain distinctions in the marketable qualities of this fish that may have been attributed to other causes? I have often eaten herrings that were caught upon the coast of Wales, and have been at all times satisfied when I ate them that they had a flavour very different from those which I have eaten in Scotland; and in Scotland, the Loch-fine herrings have been in general reckoned far superior to those taken on the east coast. Nor are herrings peculiar to the European seas; they are, or might be, also caught in great abundance at certain seasons of the year on all the northern shores of the American States; but these herrings are so much inferior in quality to those in Europe, that no one ever attempts to catch them as food for man. This shows that they must be at least a distinct *variety*. I regret, however, that I have not been able to learn whether they constitute a distinct *species*.

One other singularity respecting the natural history of the herring, that is connected with its migrations, deserves to be here noticed, as it is a circumstance that, so far as I know, has not a parallel: On account of this singularity however, though I deem it deserving of notice, it is proper I should at the same time specify that I do not mention it on my own proper authority, for I never saw it; but upon the *invariable* report of all the persons that I ever conversed with, who have lived on the coasts which herrings frequent, as well as those who have prosecuted the herring fishery as a buſineſs; who unanimouſly agree in aſserting it as an undeniable fact, that when the herrings, after appearing in any arm of the sea in great numbers, and remaining there for some time, are about to leave it, as a preliminary to their departure a signal is given, which the people who speak of it denominate *the cracking of the herrings*. By this phrase they mean to denote, that a loud sound is heard, resembling the crack of a pistol when it is fired off, which generally takes place in the evening; and it is invariably the case, they say, that after such sound has been heard, the herrings will wholly disappear from that place before the next morning.

Such is the unvarying report of those people; nor did I find one, even among the higher claſses, who did not concur in, and firmly believe it; yet I am by no means satisfied that this opinion may not originate in some accidental unobserved circumstance, which would appear nothing extraordinary if clearly explained. No one pretends to conjecture in what way this sound can be produced. That opinions, which were as generally adopted in former times as this is, once prevailed respecting the herring, which are now proved to be erroneous, is clearly demonstrable. Among the vulgar, who have only *heard* of herrings, it is a very prevailing notion to this day, that the herrings have a king; and this opinion must have been once entertained even among well-informed people in the days of Guicciardini, otherwise that well-informed author could not have adopted it. The following is a literal translation of what he says on this subject. « They have among them, without any doubt, some kings, in the same manner as the bees have; only these are of the same size and form with the other herrings, and not larger, as is the case with the king of the bees; [the sex was not then discovered] but they have, in truth, a mark on the head which appears like a crown, and they are of reddish colour, especially the head. This king going before, is followed by the whole body; and because they have shining eyes like fire, they appear at night like lightning, which is vulgarly called the lightning of the sea." This idea has long been entirely exploded, and the flashes of the sea are well known to owe their origin to another cause.

As herrings eat no known solid food, they are never to be taken by means of bait of any kind. The usual mode of fishing for them is with nets, which are not hauled on shore like those for catching salmon and many other sorts of fish; these nets are merely suspended in the water in a perpendicular position by means of leaden weights fastened to one of the edges by way of sinkers, and buoys on the other edge to keep it afloat. These nets being let down among the body of the herrings, individual fish are entangled in the meshes as they attempt to paſs through them, and thus are hauled into the boats in immense quantities. In consequence of this mode of fishing having been long pursued, several peculiarities respecting this interesting creature have been brought to light that deserve to be specified.

In the first place, as it has never been observed, that the nets catch more in general when they are placed in one direction than another, fishermen observe no sort of regularity in this respect, but lay their nets indifferently in whatever direction accident may suggest. This affords a strong corroborative evidence, that the supposed regular progreſs of the herrings from north to south is merely hypothetical; for, had the theory been just, more must have invariably been caught when the nets were stretched from east to west, and thus placed directly to thwart their progreſs, than when placed from north to south, which by being parallel to their rout, could have interrupted few or none.

Secondly, it has been thus ascertained, that at times the whole body of the fish are nearly of one size, so that they can be caught only by nets of one size of mesh; insomuch that one boat, which has nets of the proper size, will catch vast abundance of fish, while another boat along-side of it, with nets of a different size of mesh, shall not be able to catch a single herring. At other times, however, the fishing will be nearly equally abundant with the nets of a large, of a small, or of a middle-sized mesh; which indicates, that they are sometimes of one sort only, and at other times of various sorts or sizes intermixed.

Thirdly, it has been thus also ascertained, that the herring not only keep together in a compact body, whose limits, when viewed horizontally, are pretty distinctly defined, in as far as respects their progreſs towards any point of the compaſs, but that the limits of this body are equally defined in respect to the depth at which they swim. At some times the upper parts of the nets must be kept nearly level with the surface of the water, or few will be taken; at other times the buoy ropes must be lengthened to several fathoms, or no fish will be caught. In the first case, the whole body of the fish rise near to the surface of the water; in the last, they as carefully avoid it; but keep nevertheleſs nearly at the same depth for a time. This renders it extremely probable, that they may sometimes choose to take their station so deep as to be wholly beyond the reach of human power, though still in the same seas, where they might be caught in great abundance could we reach them. It is only when they are near the surface that they can be discovered by gannets and other sea fowl, who then hover over them, and, by darting from a great height, dive among them, and catch many, exhibiting a singular spectacle to those who behold it for the first time. It is then alone also, as I suspect, that they are followed by whales, who prey upon them as a favourite food.

When they rise quite near the surface of the water, these little fish exhibit a phænomenon at times that is very amusing, and that is among the vulgar called the play of the herring. This is most frequently observed towards the evening, when the weather is warm and still. It produces, to one who listens, a sound that bears a near resemblance to the patter made by large drops of rain falling on water; nor does it much differ from this appearance when looked at. It seems to me that the herring rises then to the surface, which it just penetrates with its nose, or some other part of its body, but never rises so far as to be seen. It bears no sort of resemblance to the leaping of other fishes after flies, or other insects, unleſs it be that of a sly old trout, which sometimes merely dimples the surface, but is afraid to venture farther. This kind of play I have often witneſsed myself.

My limits preventing me from proceeding farther in this investigation of the nature and habitudes of fishes, I must here conclude this disquisition; but not before I have mentioned an ingenious contrivance adopted by a very worthy man, Mr. Arbuthnot at Peterhead, North Britain, which promises to afford facilities in regard to the study of this branch of natural history, that it never hitherto has enjoyed. This gentleman has contrived to excavate many large basons out of the solid granite rock in the neighbourhood of Peterhead. These basons he can fill at pleasure with salt water at high tide time, and empty at low water. Several of these large reservoirs he appropriates for the purpose of sea bathing, which offer facilities and elegances in this respect that have been hitherto deemed unattainable. Into the other reservoirs he means to put sea fishes of various sorts alive, when recently taken by the fishermen, of which great abundance can be there caught; and there he purposes to preserve and feed them occasionally for the London market. As the water is clear and still in these reservoirs, the fishes can be seen with great ease in all their movements and practices; and there, of course, the naturalist may prosecute his observations with pleasure.

The undertaking is as yet in its infancy, so that no time has been allowed to ascertain facts with accuracy. One fact only that has been thus ascertained has come to my knowledge; which is, the remarkable docility and quickneſs of comprehension of the common haddock when compared with others. This little fish is so acute in its perceptions, as to be tamed almost in an instant; so that, if it be fed, it begins to know its benefactor in a day or two, flies towards him the moment he appears, and follows him as far as the element that it inhabits will permit wherever he goes, nearly after the manner of a dog. The remarkable voracity of the cod fish is here also proved in the most decisive manner; and many other curious facts may thus be ascertained; on which account I beg leave to recommend this invention to the notice of the curious,

This pleasing history of the herring being brought to a conclusion, the Editor of these Eſsays flatters himself that an account of the manner of conducting the herring fishery upon the west coast of Scotland, will be an acceptable addition to it. And as the information comes from respectable authority, it is here given in the words of the Collector and

Comptroller of the Customs at Port Glasgow, as transmitted by them to the Commiſsioners of the Customs at Edinburgh.

"When the buſses are at the fishery, they are constantly plying from loch to loch in search of herrings; when they appear on the coast, the buſses come to anchor in the nearest harbours to the fishing ground, from whence they send their boats to fish. Each boat requires four men, and are in number according to the proportion of tonnage. They leave a man or two on board the buſs to take care of her. In a scarce fishing, each boat has two trains of nets, 288 yards long, and from 11 to 12 yards deep. When herrings are plenty, half this quantity is sufficient. The nets are set beginning with the first end to windward, and stretching the train right to leeward. If in deep water, (which is generally the case before the herrings set into the lochs) both trains are tied together by the back rope and sole or skonke, which will stretch 576 yards in length; and in this case the boat is tied to the leeward end of the train, and allowed to drive with the nets to the leeward, the fishermen every half hour or oftener trying if there are any herrings in their nets. This they do by warping along the back rope, and here and there raising a piece of the netting. By this means they not only find when they are upon good fishing ground, but they see when the herrings swim high or low, and they raise or sink their nets accordingly, by shortening or lengthening the ropes that are fastened to the buoys which sustain the nets.

"When the night happens not to be very dark, they fix a large buoy to the leeward end of their train, and go with their boat to some distance from their nets, trying as they go along if there be any herrings in their neighbours nets: whenever they find herrings plentier in their neighbours nets than in their own, they immediately return to, and raise their train; and after shaking out their herrings (if any) into their boat, they set their train as near the place where they found the herrings as poſsible.

"Thus they are employed without interruption the whole night, 16 or 18 hours at a time when herrings are scarce, insomuch that in that time they will traverse from place to place some nights not under 20 miles, and set their nets 10 or 12 times in different places, and in the morning when day-light comes in, they repair to their respective buſses.

"When the herrings are plenty, they are generally in the lochs and in the shallow water. In this case, they get but little toil at night, having nothing to do but to set their nets in the evening, with a stone or small anchor to each end of their train, and they do not raise or hawl them till the next morning. In this case they set their trains separately, and near to the buſses, on board of which they sleep all night.

"The crews of the buſses are for the most part engaged by the month; their wages, upon an average, is 27s. per month each, besides two barrels of herrings to each man by way of portage, in case of a full cargo, and in that proportion for a smaller quantity.

"Five-sixths of the men employed in the fishery are green, and there is not above one or two thorough-bred seamen in each buſs. These green men seldom continue at the fishing above two or three years, when they go on board ships in the foreign trade.

"The present practice differs in many respects from what was formerly followed; but in none so materially as in the method of curing the herrings;—near double the quantity of salt being now expended more than formerly, it being found absolutely neceſsary for the preservation, especially to the West-India market, where their character is now established.

"The materials for fishing, and the buſses themselves, are much better adapted than formerly; but the manner of setting the nets is nearly the same.

"These improvements, the extensive scale upon which this fishery is now carried on, and the high degree of credit at which it has arrived, can only be attributed to the bounties. They have been the happy means of thousands of industrious poor being employed in all the various branches of this fishery, and of transforming an indolent people, formerly unaccustomed to any sort of labour, into active, hardy, useful members of society. It has opened the first nursery for seamen in Great Britain, insomuch that almost all the ships in Clyde, and, as we are informed, many in the ports of Whitehaven, Bristol, Liverpool, and other sea ports in England, are manned partly with seamen bred in the fishery; nay, it is generally believed, that almost one-half of the Scots seamen employed in his Majesty's navy, have received their education in that school.

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